

BEWARE OF THE AUTO-ACCIDENT FAKERS!

POPULAR SCIENCE



MAY • 35c *Monthly*

5th Wheel RUNS NEW BUS



PLUS FREE
BLUEPRINT

Multi-Purpose Yard Tractor

The Truth About Patching Tubeless Tires

Read About the Hospitalization Policy 50 Million Families Have Been Waiting For!

NOW! HOSPITAL-MEDICAL-SURGICAL INSURANCE

**PAYS MONEY
WHEN YOU'RE
SICK!**



**GIVES MONEY
BACK IF YOU
STAY WELL!**



*Either Way
You **MUST** Collect!*

WHEN SICKNESS OR ACCIDENT STRIKES, YOU COLLECT GENEROUS BENEFITS

With medical costs skyrocketing, only 1 person in 8 has enough hospitalization insurance. Now a new kind of plan gives the CASH PROTECTION you need when you're sick or hurt. Specific benefits for doctors, hospital rooms, surgeon's fees, drugs, even medicine prescribed when you are out of the hospital. If you stay well and don't use all the benefits, you get a contingent CASH REFUND. The amount depends on the benefits you have already received, and the length of time the policy has been in force.

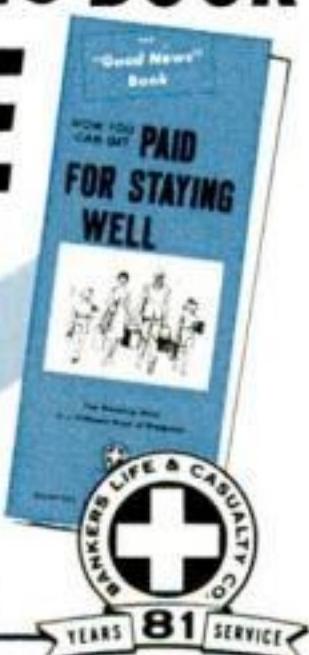
STAY WELL AND GET CASH BACK

Why shouldn't your hospitalization pay you money back if you stay well? Here's a plan that provides cash to help you pay the bills when you're sick or hurt — then, if you stay well, you get money back. You can't lose. If you need the money, it's there to help you; if you don't, you've built a savings account of your own. This new kind of protection, Policy NC-701, is available only from Bankers Life & Casualty Company as part of the famous White Cross Plan. Write today for your FREE GOOD NEWS BOOK that gives full details, tells six advantages never before combined in one policy.

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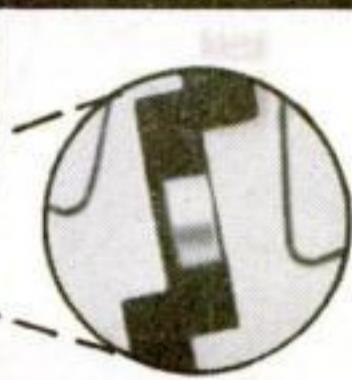
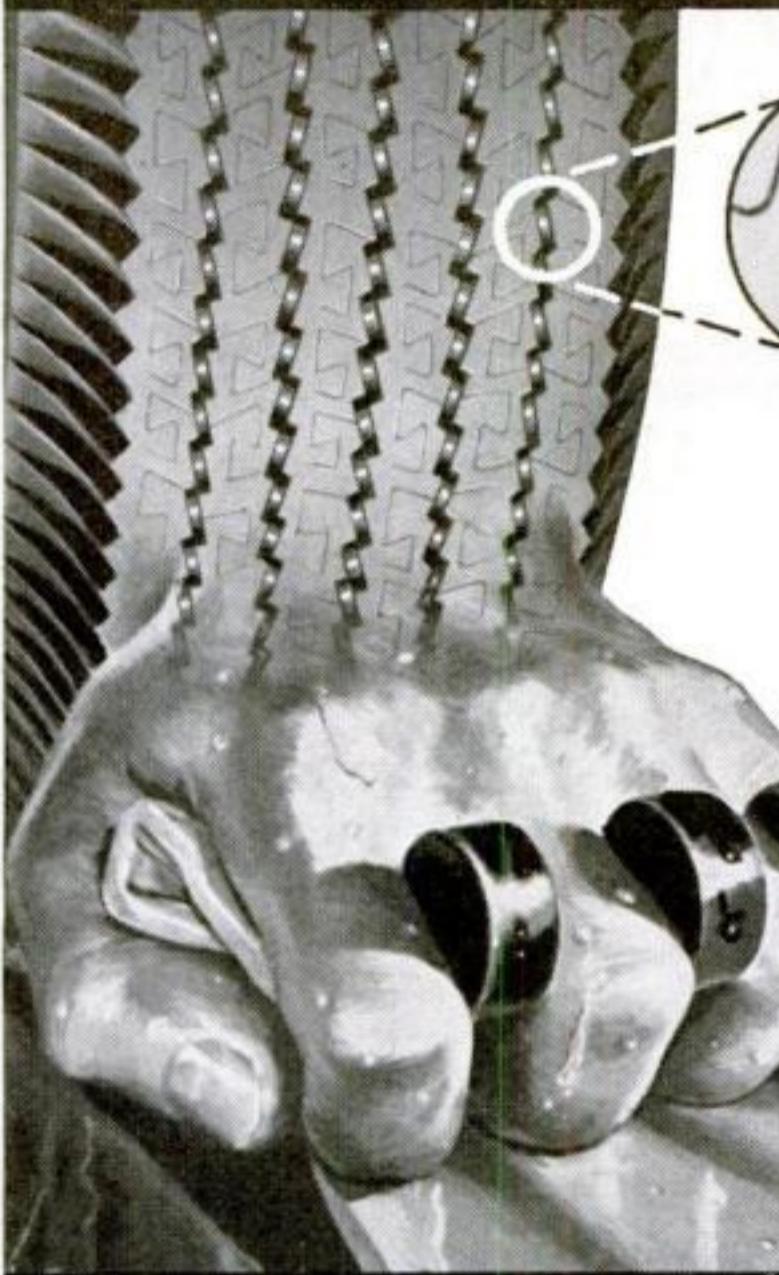
NOW you can get the vital protection you need to help meet today's rising medical costs. Write for your FREE GOOD NEWS BOOK TODAY. Read how rates can't be raised EVER. Read how after 3 years you can build cash values as long as you pay the premiums. Read how you get the full face value of the policy either in specified benefits or in a contingent cash refund. Read about the generous payments specified for doctor, hospital room, drugs, surgery, etc. Read about the reasonable waiting periods and exceptions that help keep the cost low. Look over the GOOD NEWS BOOK in your own home; decide for yourself whether you want the one policy that guarantees you can't lose.

THE WHITE CROSS PLAN offered by BANKERS LIFE & CASUALTY COMPANY

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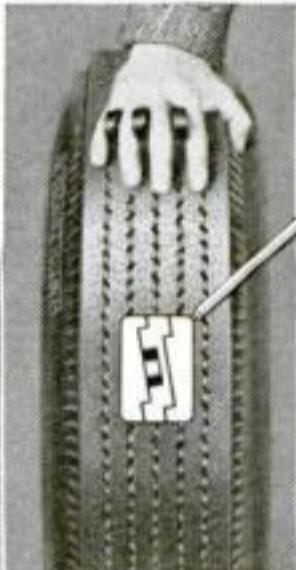
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— Makes them grip the road to stop
deadly skids as no other tires can.

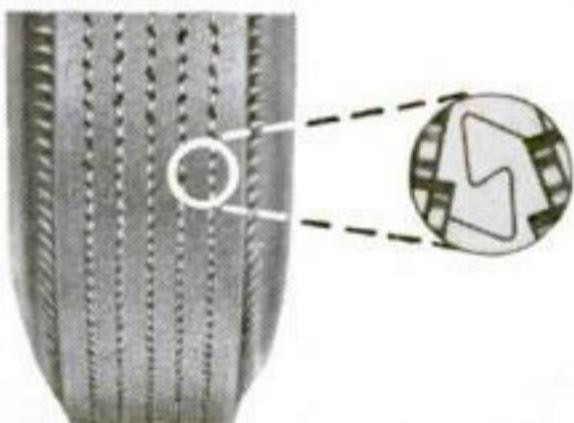
When you hit your brakes, the weight of your car is thrown on the tires. Their tread can be squeezed together into a smooth, slippery surface. To overcome this danger, Armstrong engineers invented the famous Safety Disc tread design, which holds the tread ribs open, always ready to grip the road to stop deadly skids.



OVER 1000 SAFETY DISCS

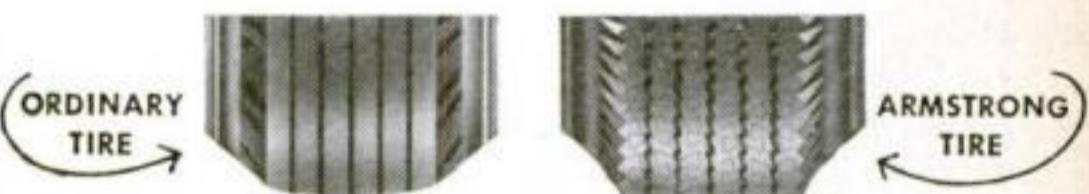
are *molded* between the tread ribs of the Armstrong tire. Just as the discs in hand at left keep the fingers apart, so Safety Discs keep the tire's gripping edges apart. They can't squeeze smooth, no matter how hard you brake. But the tread of ordinary tires, lacking discs, *can* squeeze together, go smooth . . . and you skid!

Patented Interlocking Sipes
ADD GRIP in ALL DIRECTIONS



Sipes are slots put in tire tread to add gripping edges. Armstrong's S-shape *interlocking* siping gives sharply improved traction to protect against both forward and side skids.

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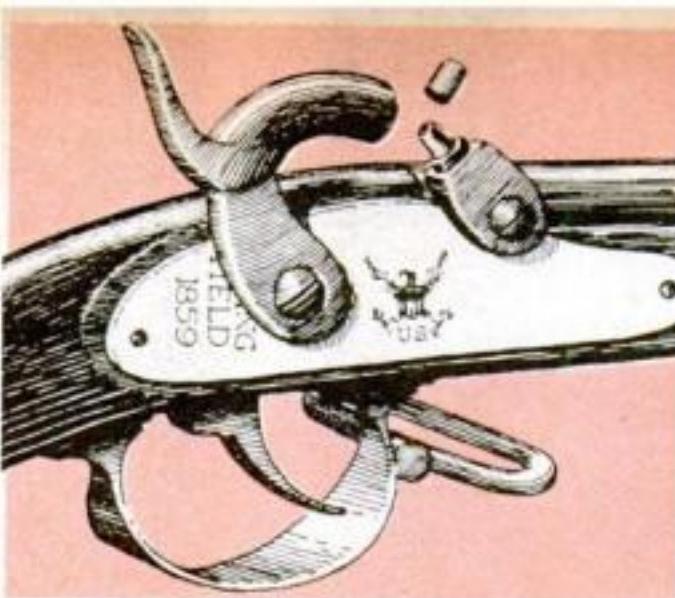
Diagrams show Armstrong tread is flatter when inflated and rolling. Gives more road contact, greater stability and traction — vital for today's high-power cars and express highways. Armstrong Tires grip the road to stop deadly skids as no other tires can!

GET EXTRA SAFETY AT NO EXTRA COST WITH ARMSTRONG TIRES!

Armstrong Rubber Company, Home Office, West Haven, Conn.



*Accident fakers: Beware—
they're out for blood.* P. 51



*Civil War: The guns that
wrote sad history.* P. 72



*Cavemen: 8000 B.C.—
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Popular Science

May, 1961

Cover painting by Ray Pioch

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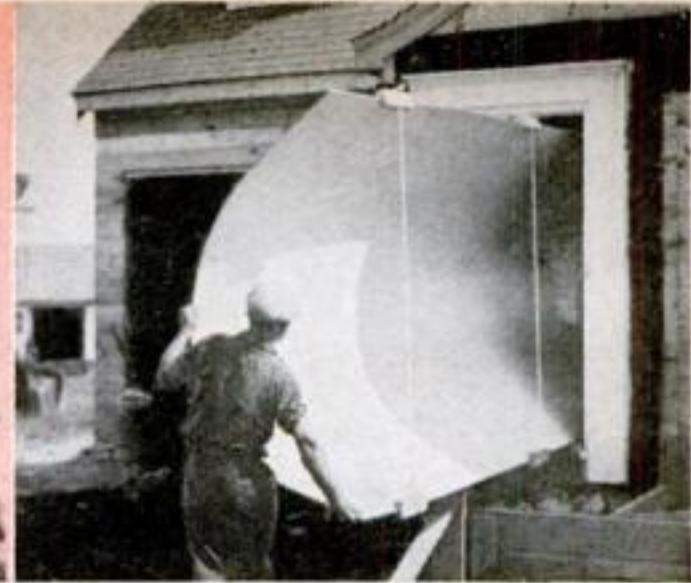
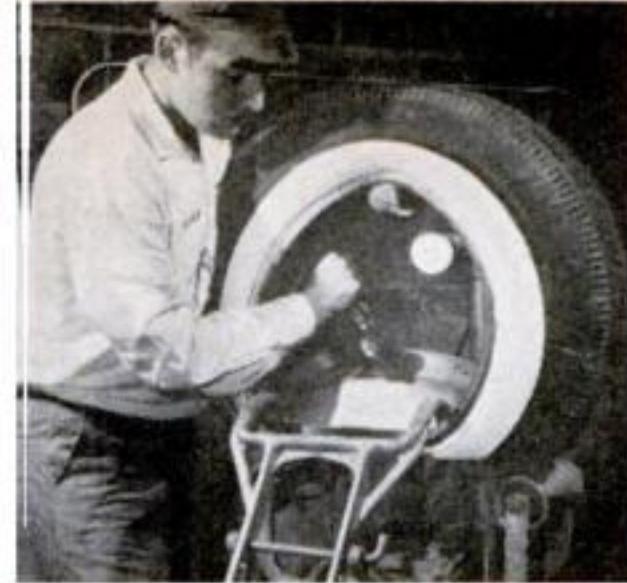
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PS Readers

TALK BACK



Somebody Out There Likes Us

I WOULD like to comment on the very great contribution of POPULAR SCIENCE in the field of traffic-safety education. Your consistent good judgment in selection of authors and subject material cannot fail to have a tremendous influence on hundreds of thousands of drivers, and lead toward professionalism in the operation of a motor vehicle—which should be the ultimate objective of every driver.

Congratulations on using your columns in this continuing battle for survival.

BOB EASTMAN, MGR.
Okla. Safety Council, Inc.
Oklahoma City.

For Spring Drivers

Now that spring is here and the cars are really rolling, it might be a good idea for your readers to review last year's "Tricks for Driving Two-Lane Roads" [Aug.]. By experience I have learned a few additional tricks I'd like to pass along:

When you approach a blind curve in the outside lane, pull as far to the outside as possible. This cuts down the chance of being hit by a car drifting from the inside lane. And don't forget you have a horn. Let the unseen car know you're there.

A. F. JOHNSON, Knoxville, Tenn.

Looking Ahead 250 Years

I ENJOYED your 250-year calendar [Jan.] so much that I bound mine after clipping it out. I used scraps of leatherette seat covering. First the folded, uncut calendar was opened to the center and stapled along the center line to thin cardboard slightly larger (to allow for

trimming). The two staples were placed with prongs coming out along the back to add strength, and flattened to prevent bulges. The leatherette was cemented to the card and trimmed to size. A sprayed-on design identifies the front cover at a glance.

F. S. BIRD, Albany, Ga.

. . . IF EVERY fourth year is a leap year, how come your 250-year calendar indicates 1800 and 1900 were not leap years? If there is a leap year every fourth year, but excluding every 100th year, the year 2000 wouldn't be a leap year either. Yet it is shown as a leap year on your calendar. Why?

S. N. ROTHENBERG, Laurelton, N.Y.

According to the Gregorian calendar which we now use, century years must be divisible by 400 to qualify as leap years. Thus, 1800 and 1900 are not leap years but 2000 will be.

Texans Point with Pride

WE'VE been robbed. In "How They Built the First Underwater Theater" [Feb.], you say the Florida theater is the world's first. As a Texan, a citizen



of the largest state (Alaska is two-thirds water), I must point out that Texas takes first honors. For many years we've had an underwater theater on Spring Lake at San Marcos, midway between San Antonio and Austin.

S. M. CROSBY, Houston, Tex.

. . . TOURISTS who want to see the world's first submarine theater will have to travel highway 81 in Texas. At San Marcos, they'll find the Aquarena—a theater in which the audience is lowered

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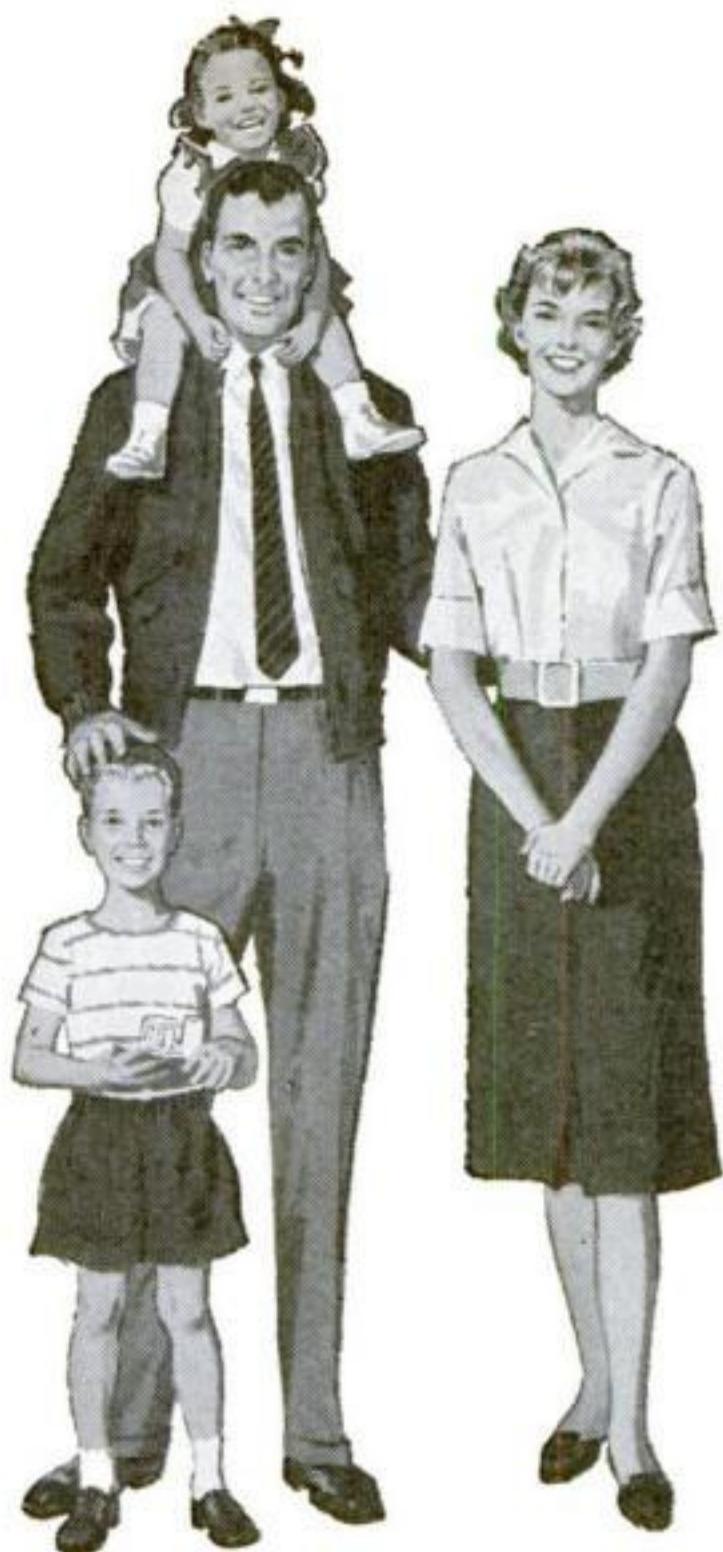
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- Diesel Engines

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below the surface of the water. It was built more than 10 years ago.

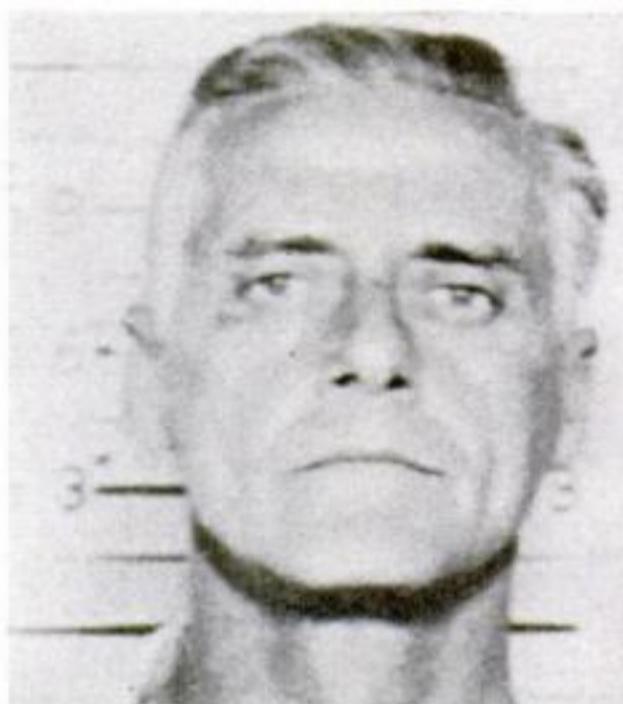
E. S. CATHRINER, Baytown, Tex.

Florida's may still be the first. Not a "submarine" theater, it is an "underwater" theater BUILT beneath the surface.

Private Eyes Wanted

KNOWING that your magazine has many readers in the garage and auto-service business, I thought some of them might be able to help the FBI locate a long-sought fugitive who may be working in the automotive field.

Edwin Thomas Huber absented himself from the 3802nd Supply Squadron, Maxwell Air Force Base, Ala., on Sept. 26, 1958, and was declared a deserter on Oct. 25, 1958. He had previously worked as an auto-parts clerk and is considered an excellent auto mechanic.



Huber is 45, white, 5 feet 11 inches tall, weighs 170 to 200 pounds, and has gray-brown hair. The first joint of his right index finger is missing.

Anyone having information concerning the whereabouts of this person please contact your local FBI office.

H. G. FOSTER, Special Agent in Charge,
FBI, NYC.

By-Product of Astronautics

I'M SURE your readers will be interested in knowing that at long last a bill has been introduced in the House of Representatives to study the practicability and desirability of the U. S. adopting the metric system of weights and measures. The bill (H.R. 269) has been referred to the Committee on Science and Astronau-

CONTINUED

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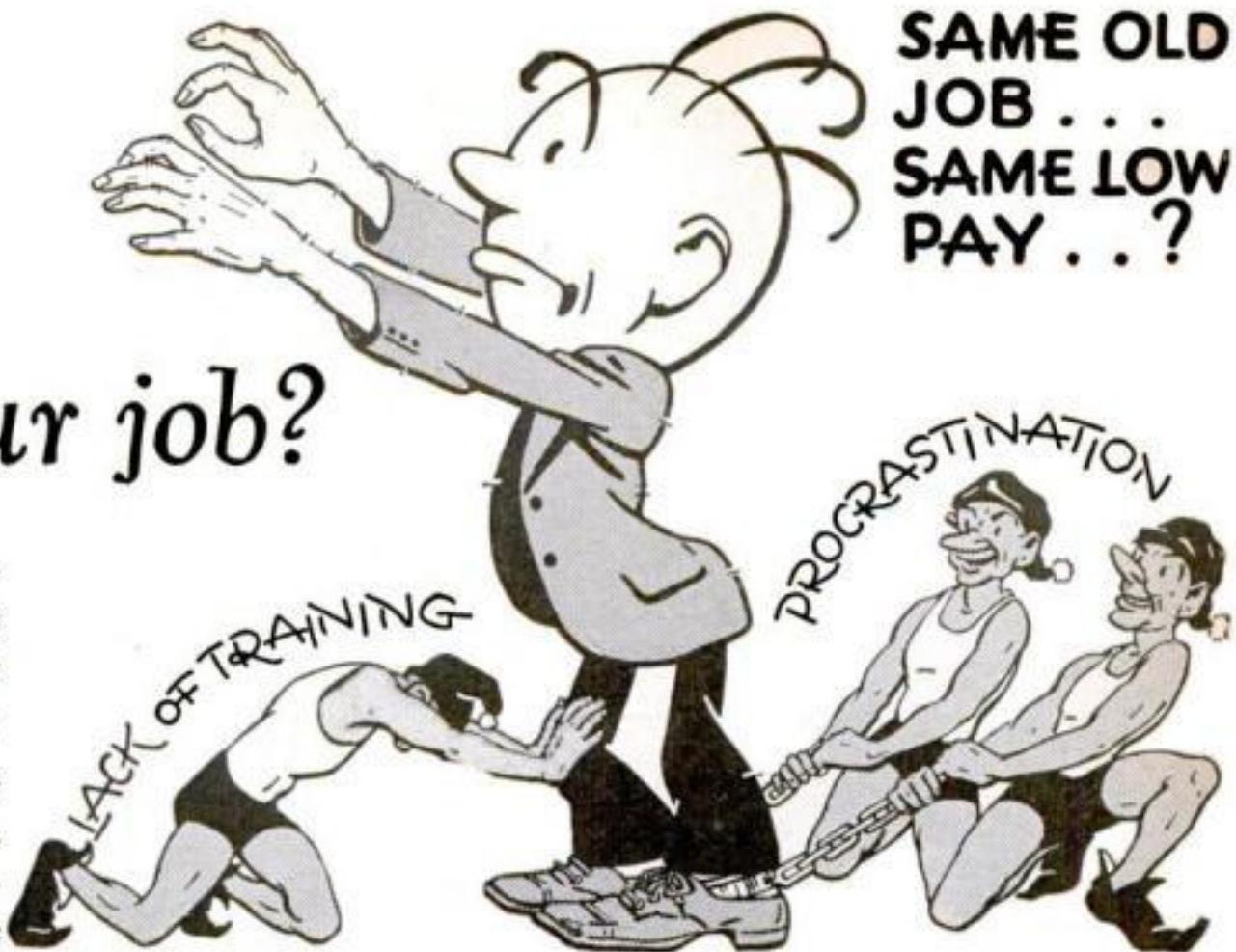
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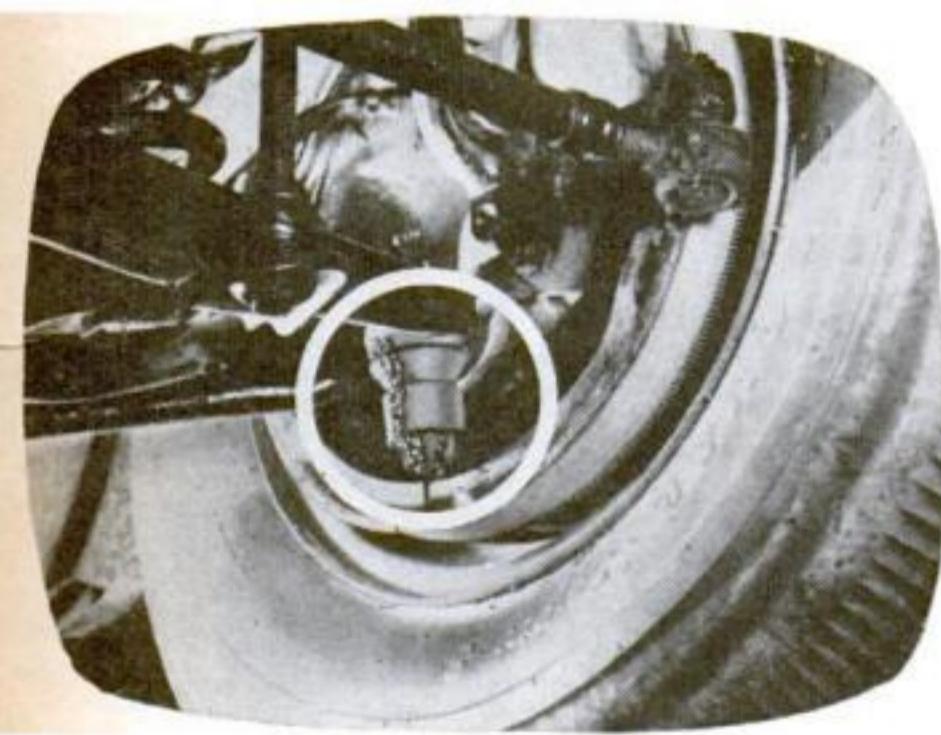
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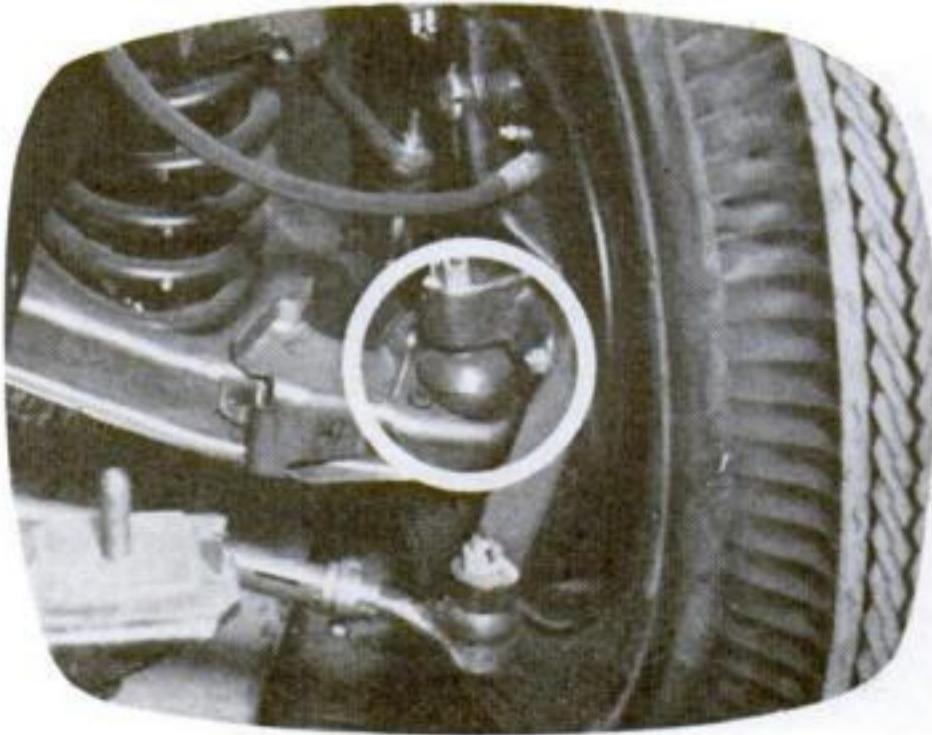


TV's Professor Jonathan Karas uses
"shock treatment" to prove . . .

Professor Jonathan Karas, physicist at Lowell Technological Institute, demonstrates, as he does on Ford TV shows, why Ford goes 30,000 miles between chassis lubrications.

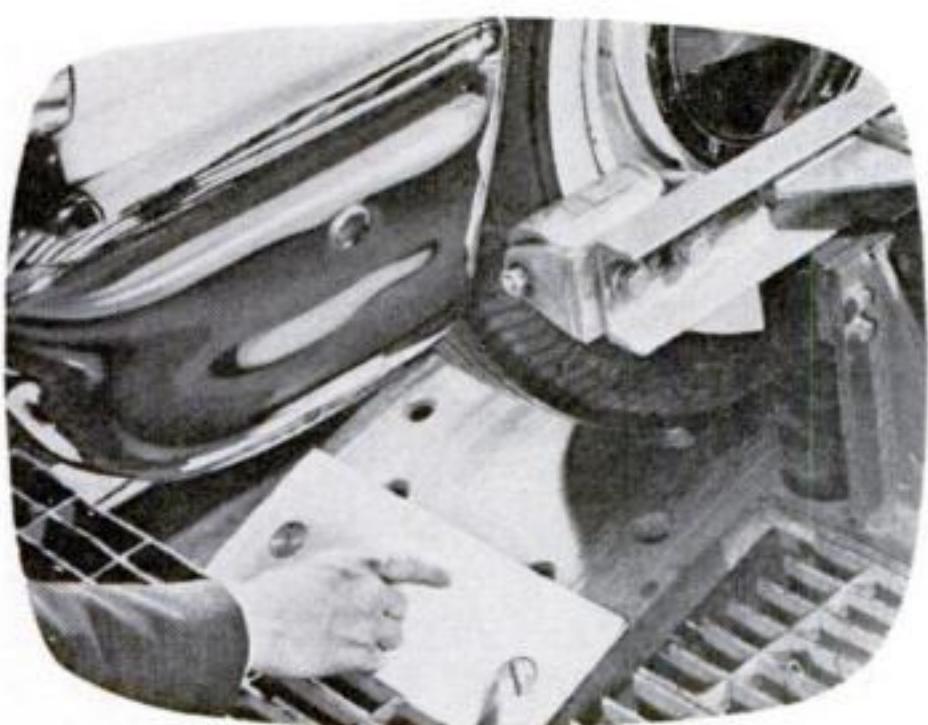


3. "Hours later, we looked at both suspensions. Here's the one on the other '61 car. See how the ball joint leaked? This is why most cars need chassis lubes every 1000 to 2000 miles."

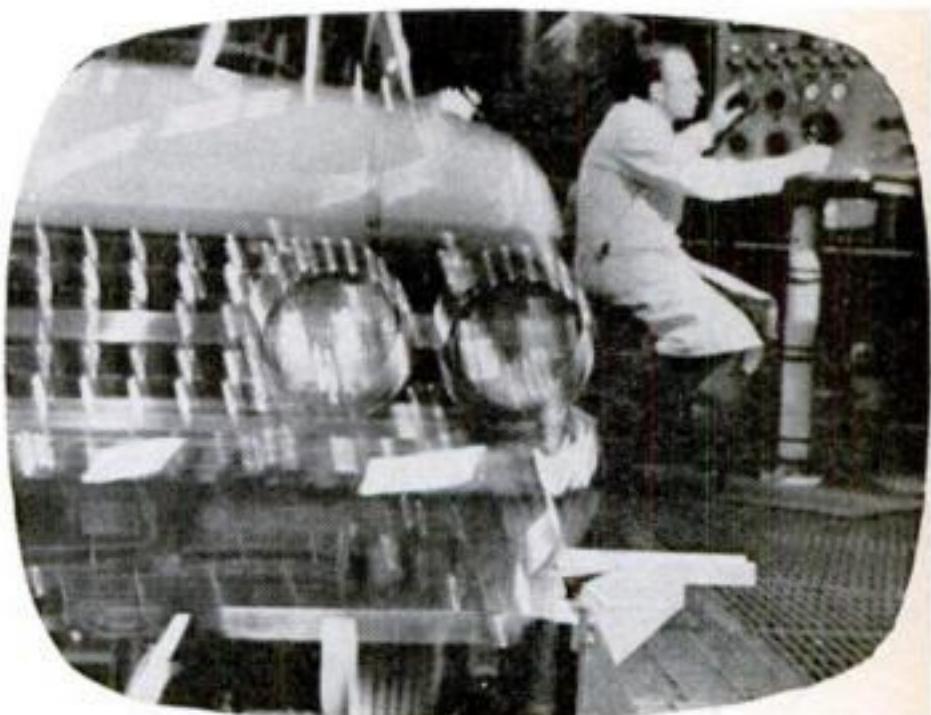


4. "Now look at Ford's suspension. No leaks. No ordinary grease fittings. Each ball joint is completely sealed in. No wonder Ford can go 30,000 miles between chassis lube jobs!"

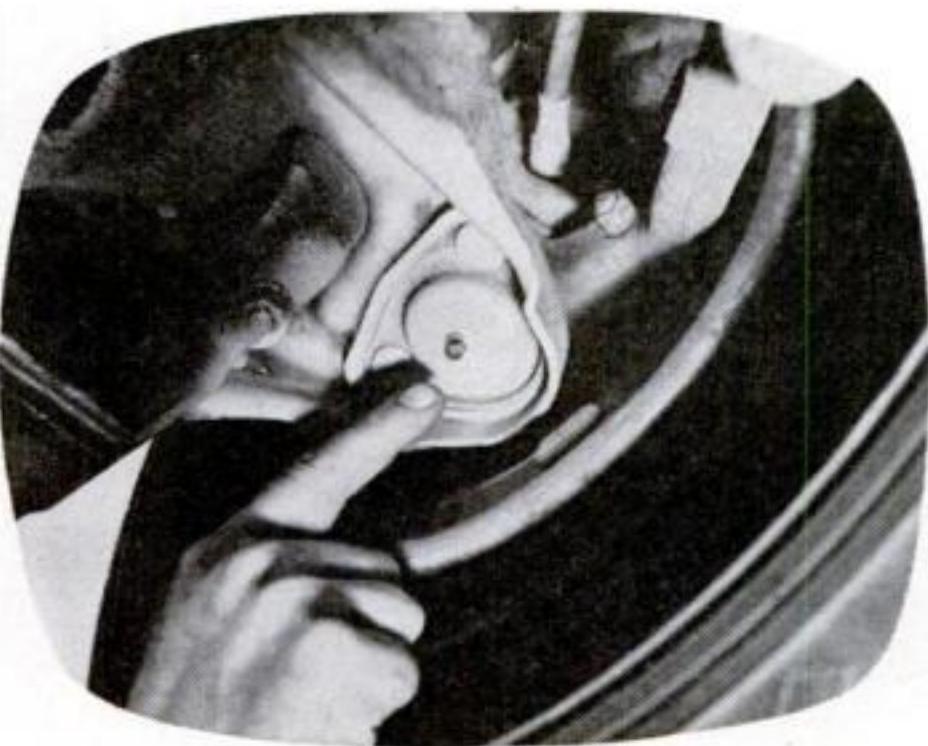
You can't pound out Ford's sealed-in lubrication!



1. "On this dynamometer is a '61 Ford, on the other one, a different '61 car. Each dynamometer has bumps attached to its rollers to give a severe shock to the car's front end."



2. "Now, we'll turn on the dynamometers and start the test. The punishment these machines dish out can be compared to a ride on a badly rutted, bumpy road."



5. "When finally you *do* lubricate, this plug is unscrewed, new molybdenum disulfide grease injected, and the plug replaced. The job costs only about \$4.00—takes about 20 minutes."



6. "30,000 miles between chassis lubrications . . . 4,000 miles between oil changes . . . self-adjusting brakes. All are features of the '61 Ford, beautifully built to take care of itself."

FORD DIVISION, *Ford Motor Company*,



time for
an oil
change?

change
to...



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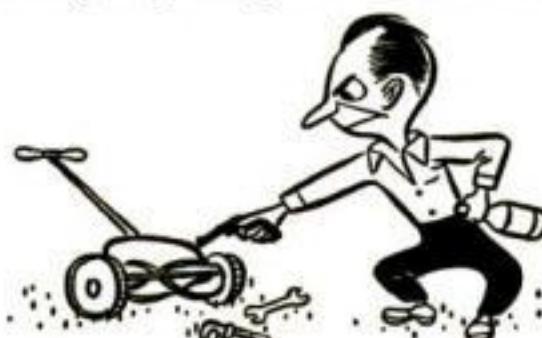
tics by Congressman James Roosevelt.

As an engineer, I have always felt our scientists and engineers have been under a handicap with our present system of measurements. Maybe some of your readers would like to write their congressmen in favor of the bill.

LEWIS J. MILLER, Los Angeles.

Robbing the Pantry Shelf

To LOOSEN rusted-on bolts and screws, I use apple-cider vinegar. It is just as effective as penetrating oil and the cost is quite a bit lower. Also, because of the acid content, it keeps the rusted spot clean for quite a while after use. In the shop, store the vinegar in a plastic bottle or toy squirt gun to make it easy to



use. Never put it in a metal oil can—it will eat through within a week or two.

J. C. WILLIAMS, Des Moines.

It All Depends on the House

A FEBRUARY short cut suggests that provision be made to supply air to furnaces when basement windows are weatherstripped. The way I interpret this, you weatherstrip to keep air out, then bore holes in the sash for louvers to let air in. I've weatherstripped and caulked everything but the keyholes in my house and my gas-converted furnace burns fine.

P. T. LANCASTER, Johnson City, N.Y.

Yep, weatherstrip to keep out large amounts of air, insert louvers to bring in the little oxygen needed to keep the home fires burning. Yours sounds like an older home not insulated to be airtight.

Building a Shop Vacuum?

I'VE just built the shop vacuum designed by Phil McCafferty ["Build Your Own Shop Vacuum Cleaner," Jan.]. Some others might like to know of one change I made.

For the wheel shown in the blueprint, I substituted a blower wheel that's made here by the Cincinnati Fan & Ventilator Co., 3548 Montgomery Road. It's made

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JOHN KING, Cincinnati.

More on Moving Stuck Cars

I HAVE a setup you missed in your bonus booklet "What to Do When Your Car Gets Stuck" [Dec.]. It will not only move a car stuck in mud, sand, or snow, but will move other heavy objects as well.

A rope is wound around an upright—a tree, a post, even the handle of a shovel. The lever may be anything stiff enough to take the pull of a man and not too clumsy. A shovel handle will do here, too. As you walk around the upright, you support it with one hand while the other turns the lever.

H. I. GRASER, Yuba City, Calif.



. . . AFTER 40 years of driving a delivery truck, I'd like to give my tip on how to get a stuck car moving.

Buy two sheets of expanded-metal lath (each two feet by eight feet). Fold each sheet in half the long way, and fold back one end (four to six inches). Attach 12 feet of metal sash chain at the strengthened four-ply end. When stuck, place the laths in front of the rear wheels with chains facing the front wheels. Clip or bolt the chains around the rear bumper so they will pull the traction pads with you onto clear ground when you pull out.

These traction pads cost about \$2.75 and you can roll them to fit the trunk.

W. S. BOWMAN, Woodbury, N.J.

Detroit Nomenclature

IN THE article on the Land Rover [Feb.], you say the gas engine of the car puts out 77 hp., the diesel 51.2 hp. These ratings are incorrect and should read 77 b.h.p. and 51.2 b.h.p. There is quite a difference.

ROBERT LEVIN, Merion Station, Pa.

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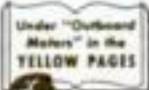
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*Selected by the editors of *Golden Argosy*, the magazine for men, and *Outdoors*, the magazine of outdoor recreation.



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Grand National Pleasure Boat Champion Drives Mercury! California's Charles Mersereau won three of the world's toughest marathons, including the 6-hour pleasure boat endurance at Kissimmee, Fla. He says: "To run first or run first class, your choice will be the same as mine — Mercury!"

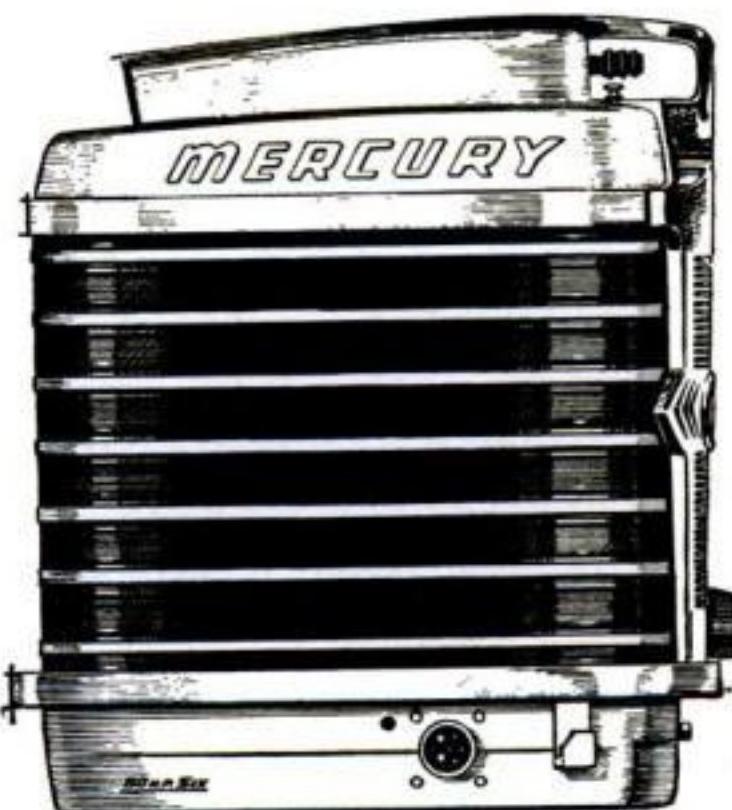
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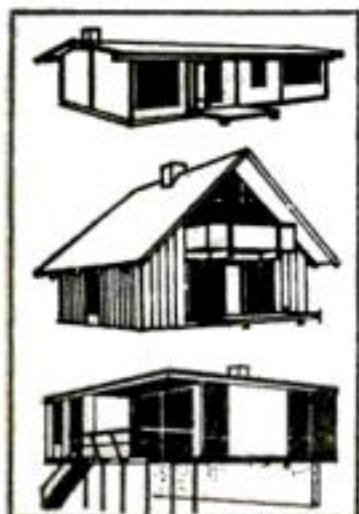
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an engine's output can be used, the term "horsepower," as used in the U.S. (including Detroit) in referring to cars, means brake horsepower.

Tips for Balky Ballpoint Pens

THE short cut on whirling a ballpoint pen on a string to make it write [Feb., p. 163] was a new one on me. But just in case you don't have any string handy when the pen conks out, here's my



method: Unscrew the pen and blow on the hole at the end of the ink cartridge.

A. D. ACKERMAN, Washington, D.C.

. . . I REMOVE the "filler" and put a lighted match (carefully) on the ball tip. *Presto!* ink flows and the pen writes.

SEELEY LINDEMAN, Cincinnati.

Tribulations of Inventors

I WAS amused and amazed to read in "New Ideas from the Inventors" [Jan.] that someone had invented a cordless iron. Let me tell you about my precious Eureka iron, now 10 years old. It wasn't new even in 1951—I'd wanted one since I was a young girl, when full-page ads on them ran in the women's magazines.

I got mine at half price because "they just didn't sell," according to the store owner, and he was trying to get rid of them. I've used mine constantly and it certainly is practical. It never overheats and, without a dangling cord, it can keep pace with a fast ironer.

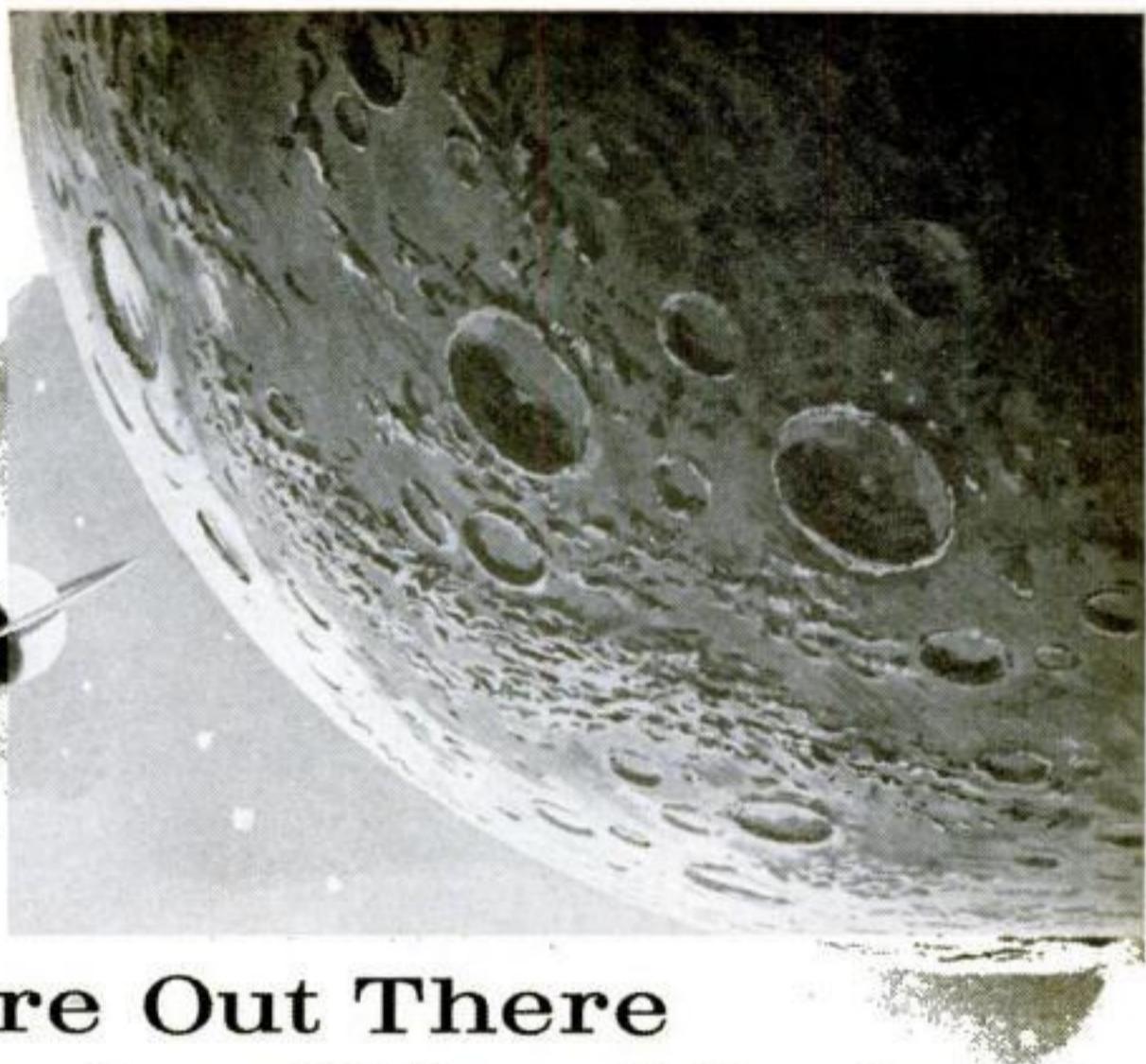
FAITH E. SNIDER, Suffern, N.Y.

. . . MY MOTHER has had an electric cordless iron for 10 years. The only difference between it and the one you show is that the heating stand has no slope. Is the Oates patent an old one?

MRS. J. W. BLEDSOE, Lyons, Ind.

Oates' patent is a recent one, first applied for in 1956. It cites patents previously granted to other inventors for similar inventions through the years 1925-1955, including several foreign ones. For an inkling of how difficult it is to get a

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patent that will successfully exclude other patents on a similar invention see "How to Protect Your Valuable Ideas" [Apr.]

... THAT firehouse-pole cushion ["New Ideas from the Inventors," Feb.] has been in use in our fire department for the last five years. And that drawing is way off. If a man were to slide down a smooth brass pole in the manner illustrated he might break his legs, and he'd most assuredly have burns on his hands and arms. Firemen never wear short-sleeved shirts; they use their arms—not hands—to slow their descent on the pole.

E. J. KRENTSA, Yonkers, N.Y.

Evidently our artist is no fireman. As for the patent, it was issued late in 1960. Possibly the cushion used in Yonkers was never patented.

Turn-Back Turn Signals

JUST read the woeful letter about the need for a turn signal that would cancel itself more dependably. Mr. Cooper might be interested to know that Simca has a timed indicator that shuts off automatically after about 20 seconds.

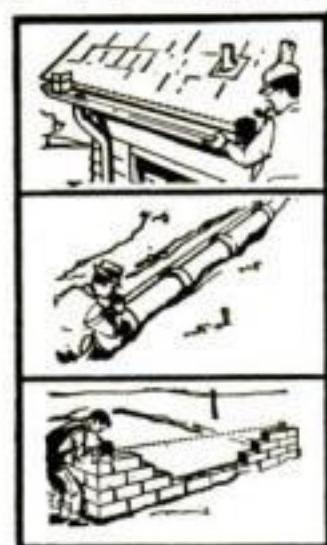
BILL ANDORFER, Ft. Wayne, Ind.

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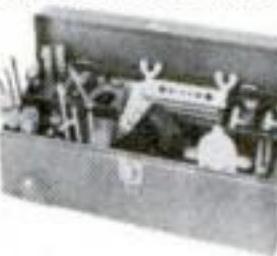
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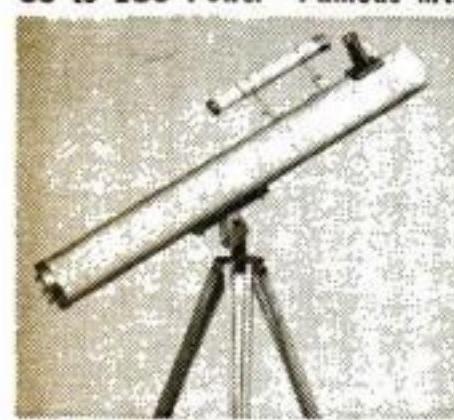
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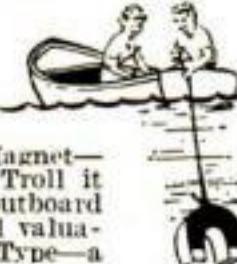
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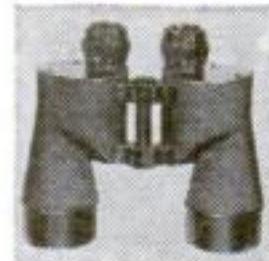
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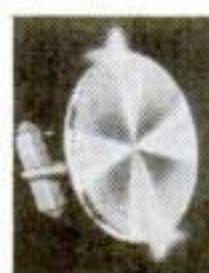
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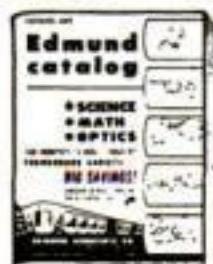
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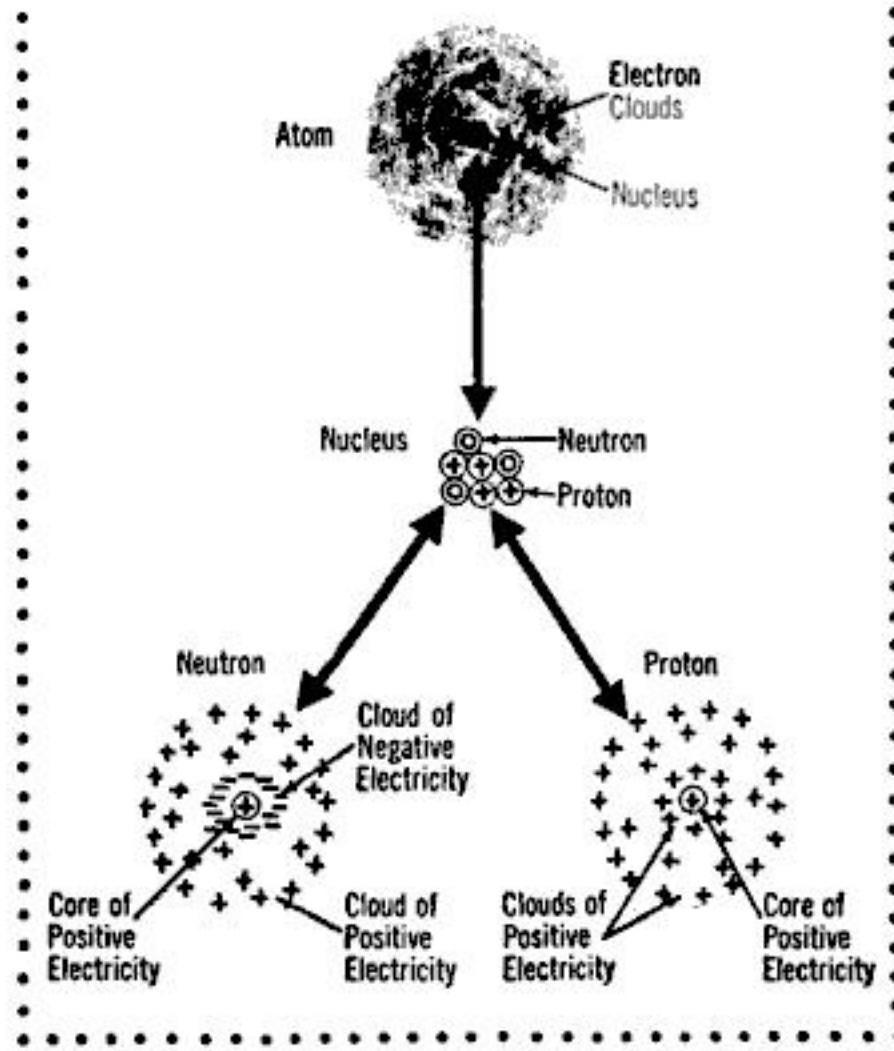


The month in science

Getting to the heart of matter. The next time Junior asks "What's inside an atom?" you can really show him. For straight from this year's meeting of the American Physical Society comes the first explanation of what goes on deep inside an atom, in the parts of its central nucleus.

Inside the nucleus are protons and neutrons, particles that are incredibly tiny (around $1/10,000,000,000,000$ inch in diameter) and unbelievably dense (480,000,000,000,000 times heavier than an equivalent volume of water). Junior probably knew that already from his science class. But now you can tell him what's inside the protons and neutrons.

Inside the Atom



Here's the picture, as outlined by Dr. Robert Hofstadter of Stanford, who worked on the problem for seven years:

►The proton contains a tight core of positive electricity. Around this core are two vague and intermingling clouds of positive electricity. That makes the proton positively charged.

►The neutron also has a tight core of positive electricity. And again there are two vague, intermingling clouds around the core. But one cloud is negative electricity, while the other—extending slightly farther out—is positive electricity. This gives the neutron a thin outer fringe of positive charge. Overall, however, the neutron's positive and negative electricity balance each other, so it has no net charge.

If Junior is obnoxiously persistent, he's liable to ask, "What are those electrical clouds made

of?" That's tougher. They seem to be mesons. "And what are mesons?" Well, hold on. Mesons are one type of the Strange Particles, the annoyingly numerous (around 30 are now known) and varied bits of matter that appear when a nucleus cracks open. The best guess is that mesons represent units of force, the fantastically powerful force that holds the nucleus together. When the nucleus does break, the holding force materializes as meson particles.

This is a good time to remind Junior to go finish his English theme. There'll be another physicists' convention next year.

Who needs speed limits? Sometimes they don't do anything at all, report Curt M. Elmberg, a Swedish traffic consultant, and Harold

CONTINUED

The month in science continued

L. Michael of Purdue, after careful tests on five roads in Indiana.

One stretch they studied was two miles of a new four-lane highway without a single speed-limit sign. The first mile gradually changed from open country to built-up suburb; the second mile was solidly residential. For six months the researchers clocked passenger cars day and night with radars hidden in the bushes (they handed out no tickets, and warned the cops not to lay on any special campaigns—just routine enforcement). Results endorse the common sense of most drivers.

In the country, 85 percent of the cars were doing around 50 or less. Approaching the built-up area, they gradually slowed to 40 or below, and then to 30 in the heavily residential section. Local cars ran a little slower than out-of-towners in the daytime, but a little faster at night.

Then the speed signs went up, one at a time. The limits posted were the maximums that 85 percent of all drivers ordinarily imposed on themselves (except in the outer stretch, where 65 is legal, though rarely seen). Secret radars clocked cars again. No great change. If anything, local drivers went a bit faster after the signs were up than they did before.

The clincher, though, is a comparison for one short stretch that was changed successively from no posted limit to 40 to 35 to 30. It didn't make any difference what kind of sign—if any—flagged the motorists. The average speed in all four cases was 32-34 m.p.h.

The Purdue report doesn't deride all speed limits. Elmberg points to Europe, which got along without any speed limits until the late 1950s. Then increasing traffic—and a soaring accident rate—lowered the boom. Accidents were reduced by speed signs. One reason: The posted limits are reasonable, about what average drivers do anyway. Another factor—supporting the Connecticut theory of heavy-handed enforcement—is the fining system. In some parts of Europe, fines vary with the income of the culprit. A speeding ticket can really hurt.

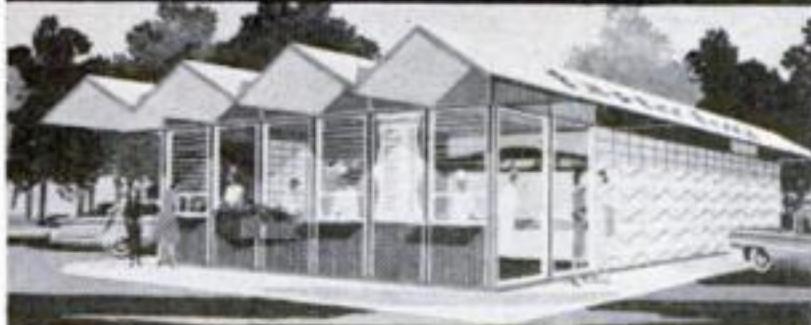
The weapons gap in 650 B.C. All that malarkey about the ancient Spartans winning every battle because they were trained from childhood to be tough, disciplined, ruthless warriors—well, it may be malarkey. The real reason the Spartans won so handily was a secret weapon: steel. They had hard steel spears when everybody else was fighting with soft iron and bronze.

That's the theory of Dr. Lyle B. Borst, New York University physicist who is an old hand at secret weapons (Manhattan Project's A-bomb). He analyzed metal fragments from Sparta and found that they were not iron money, as archaeologists had thought, but steel. At least one piece was part of a spear. And the steel is very good stuff, with nearly twice the elastic strength of modern structural steel.

The Spartans weren't the first to invent steel—it popped up, independently, all over during the 1,000 years preceding the Christian Era. But they could have been the first steelmakers in the Peloponnesus. That would have given them the same military advantage in 650 B.C. that the A-bomb gave us in 1945 A.D.

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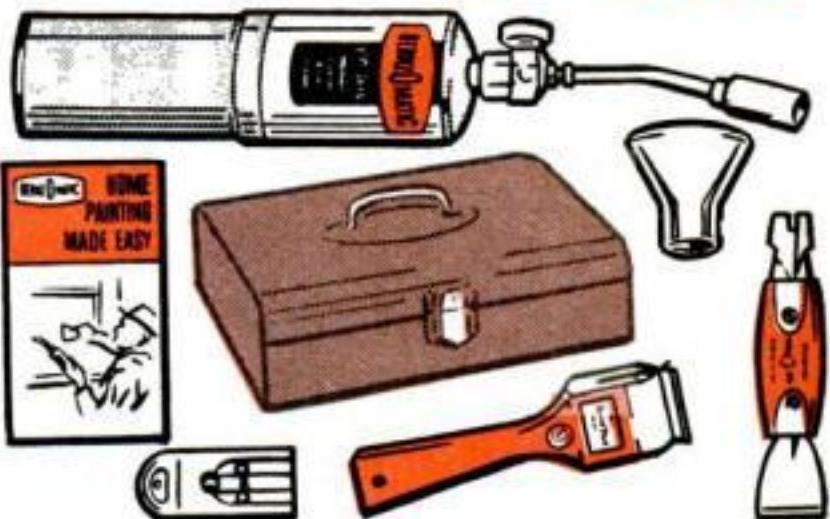
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PS Puzzlers

By Joan Steen

May teasers may be easy, maybe not . . . Answers on page 195



CHARLES BERGER

A Pinch of Poison with the Soup

FOUR men were eating together in a restaurant when one of them suddenly struggled to his feet, cried out, "I've been poisoned," and fell dead. His companions were arrested and under questioning made the following statements, one of which is false in each case:

- Watts: 1) I didn't do it.
2) I was sitting next to O'Neill.
3) We had our usual waiter today.

Rogers: 1) I was sitting across the table from Smith.
2) We had a new waiter today.
3) The waiter didn't do it.

O'Neill: 1) Rogers didn't do it.
2) The waiter poisoned Smith.
3) Watts lied when he said we had our usual waiter today.

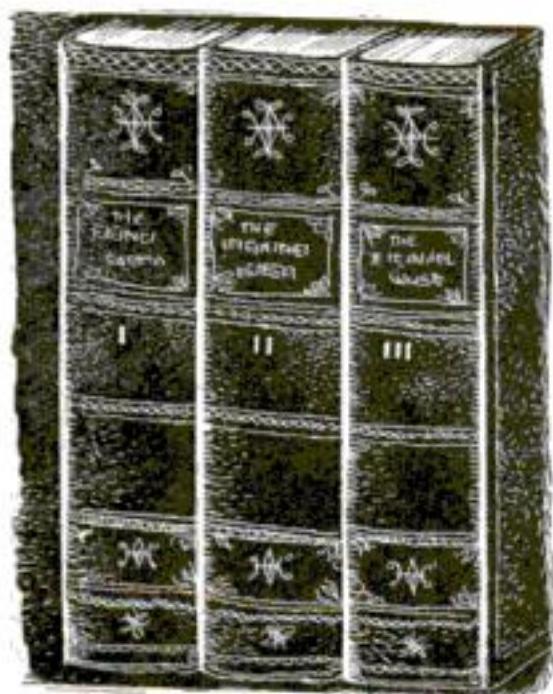
Assuming only these three and the waiter implicated, who poisoned Smith?

IT WAS Junior's birthday. "Gee, I Dad," he said, "You're just three times my age now."

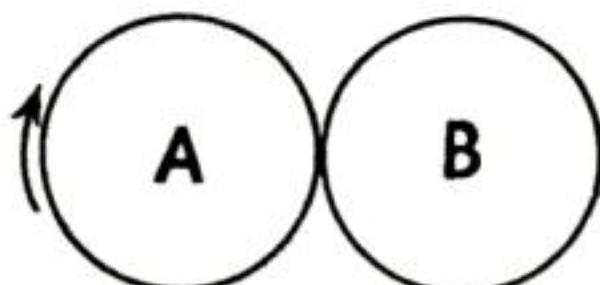
"That's right," his father said, "but four years ago I was four times as old

as you were then, do you remember?"

"But Junior's certainly catching up to us," chimed in Mom. "Why just eight years from now I'll only be twice his age!" How old is everyone?



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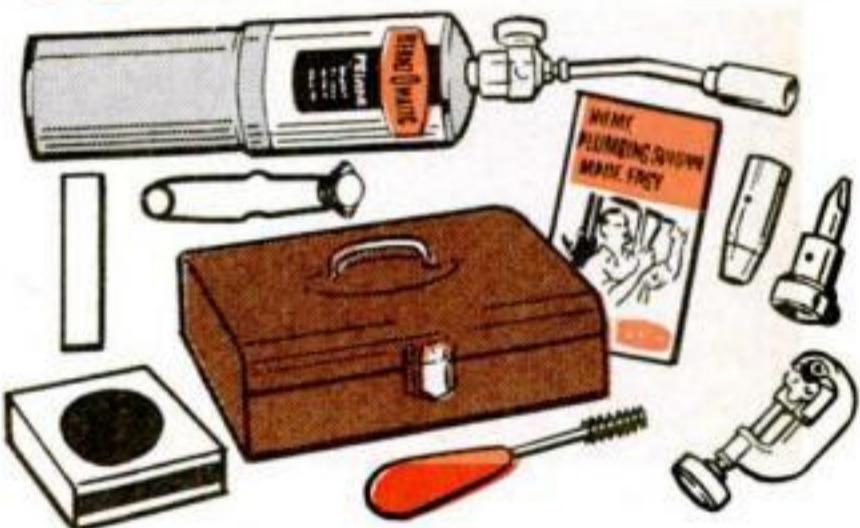
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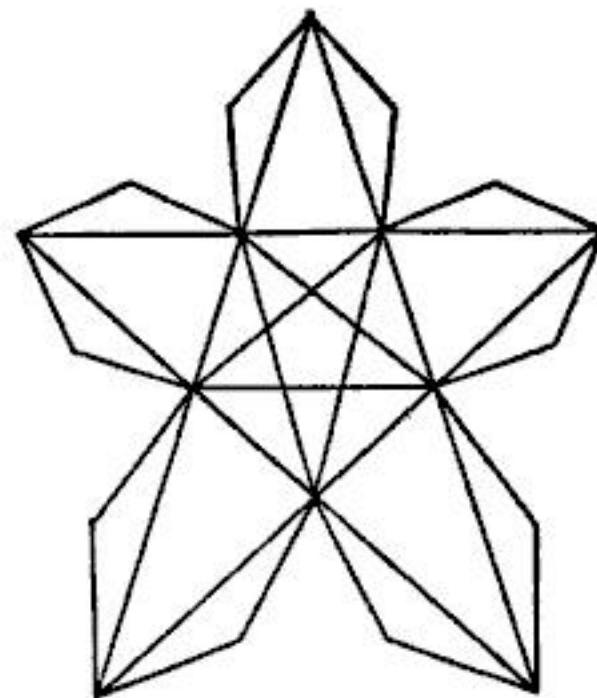
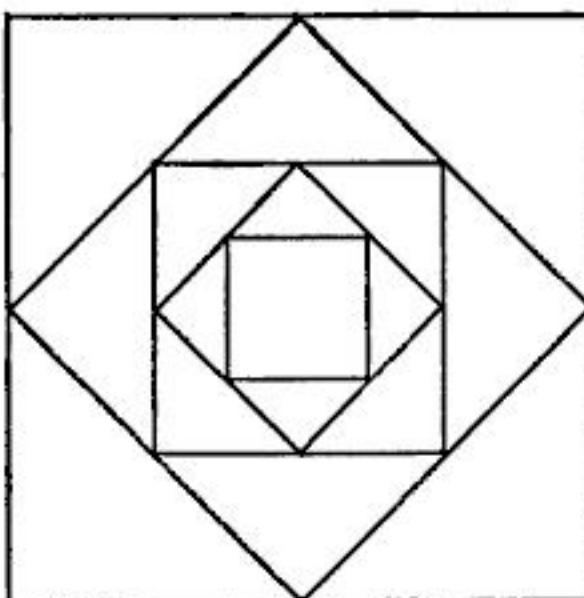
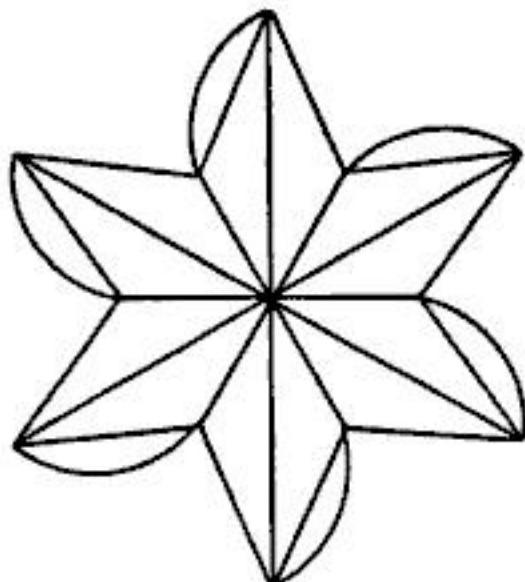
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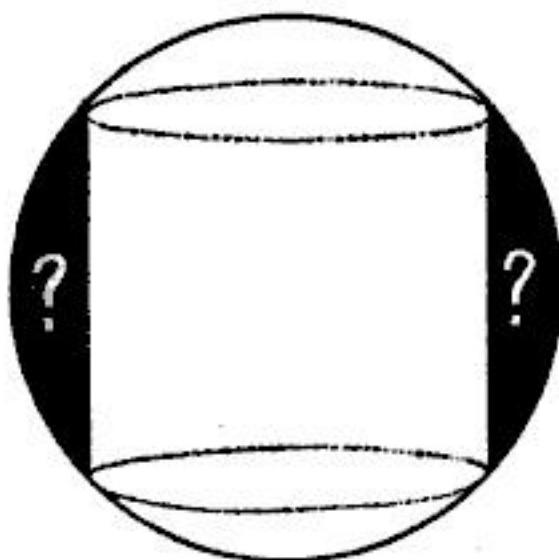
PS Puzzlers continued



FEELING smug about your facility for solving don't-lift-the-pencil and don't-cross-a-line puzzles? Then sharpen your

pencil. These (just to put you in your place) were sent in by a 12-year-old reader who is fascinated by lines.

Puzzle of the month



REMEMBER the puzzle some months ago [Oct.] about putting a string around the world? Here's a similar stickler, with nothing intrinsically difficult about it. Ready?

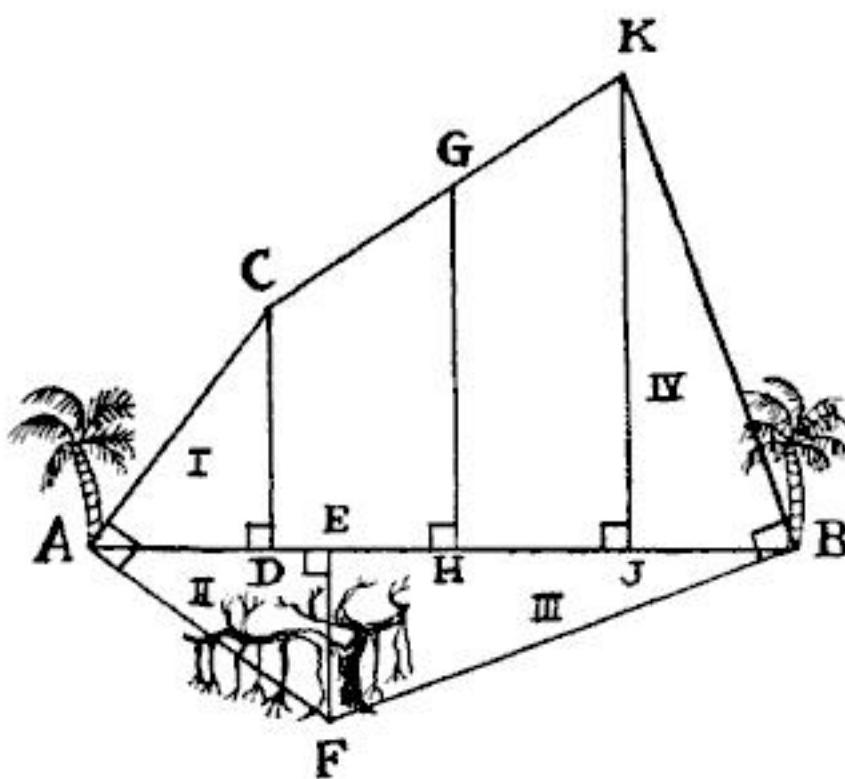
Take a solid sphere, any sphere more than six inches in diameter. Through the center of the sphere, drill a hole that measures exactly six inches in length from opening to opening. The diameter of the hole, of course, will depend on the size of the sphere. Now for the question:

What is the volume of the material remaining? Strangely enough, you have all the information you need to get an exact answer. (Answer next month.)

Answer to last month's P.O.T.M.: Two palms and a banyan tree (F) were used to mark the spot for buried treasure. The distance from the banyan to one palm was laid out again at right angles to the palm. Similarly for the distance from the banyan to the other palm. The midpoint of the line between these two new spots was chosen for the burial place. The problem: to find the spot later when the banyan tree was gone.

Intuition—or perhaps a number of trial drawings—may have suggested the answer to you: The treasure lies along the midperpendicular to the line between the palms at a distance equal to half the distance between them. Proving it is a matter of plane geometry.

Drop perpendiculars to AB at C, F, G, and K. Triangles I and II are congruent. ($AC=AF$, angle $ACD=\text{angle } EAF$, angle $CAD=\text{angle } AFE$.) Similarly triangles III and IV are congruent. So $AD=EF$, but also $BH=EF$, so $AD=BH$. Now $DH=HJ$ (lines cut by a set of parallels are divided into proportional segments and $CG=GK$). Therefore $AH=HB$ and we



have proved that GH is the midperpendicular of AB. But the length of GH is half the sum of CD + JK (again by a proportional argument) and since $CD=AE$ and $KJ=EB$ we have GH equaling half the sum of AE and EB, or half of AB.



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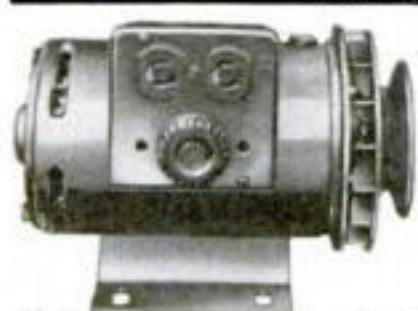
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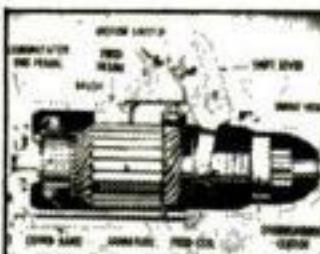
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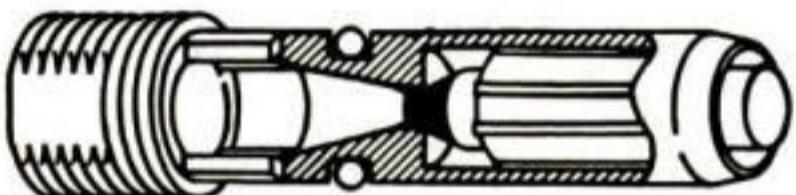
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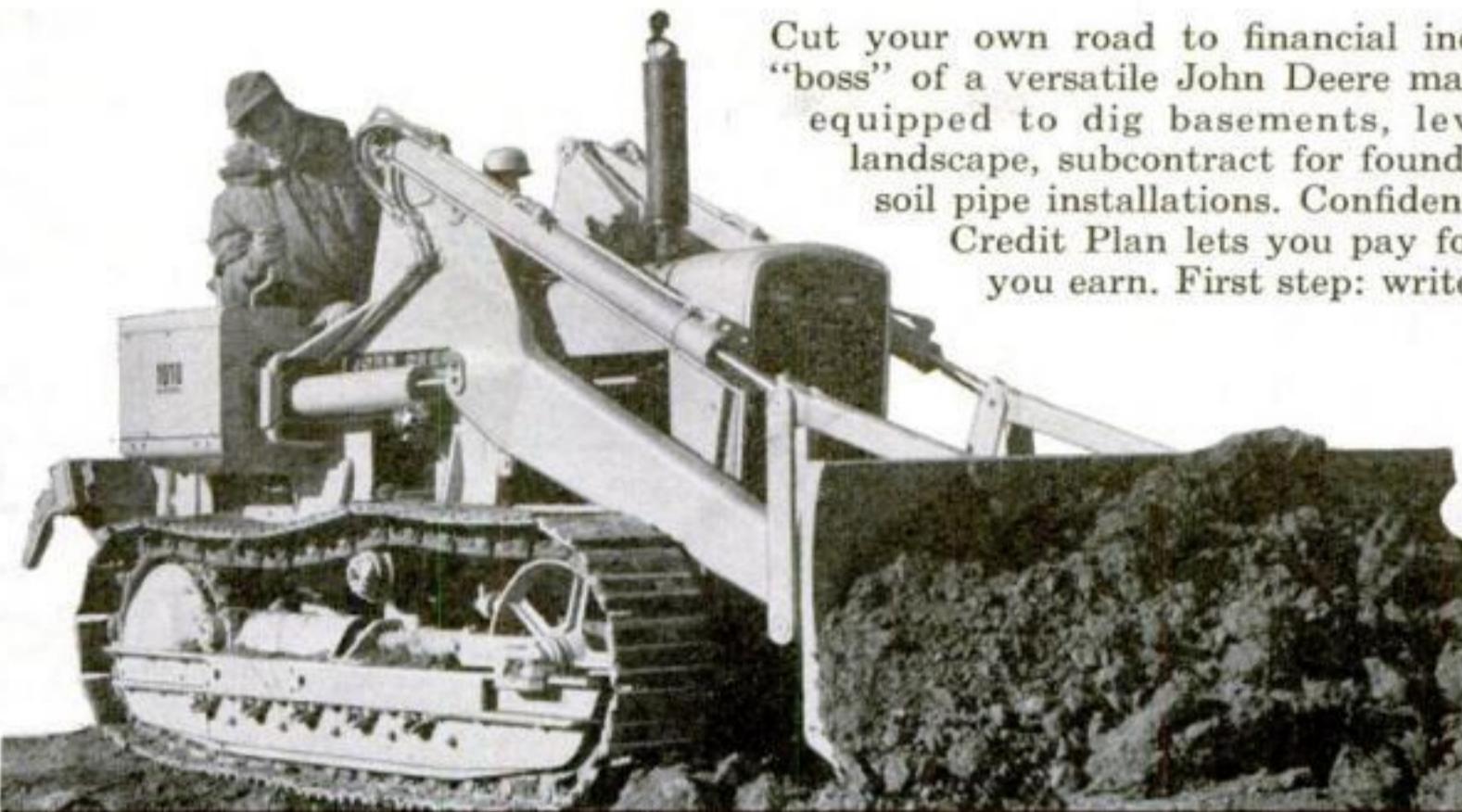
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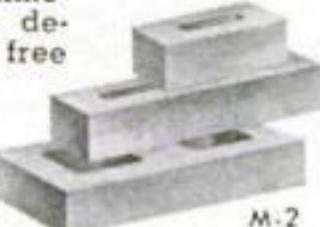
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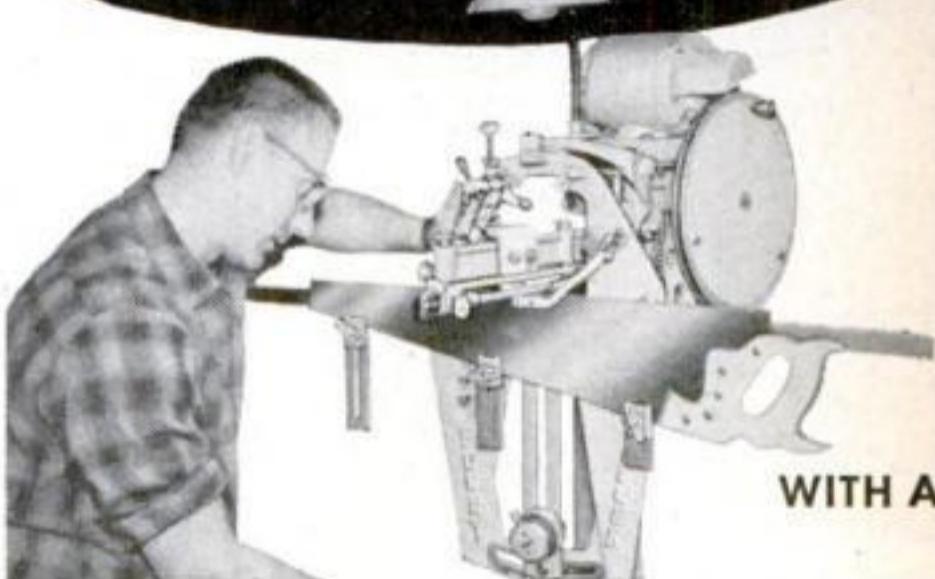
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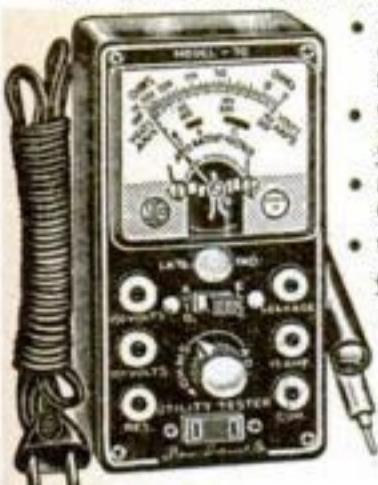
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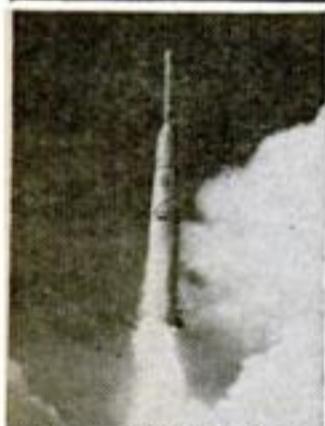
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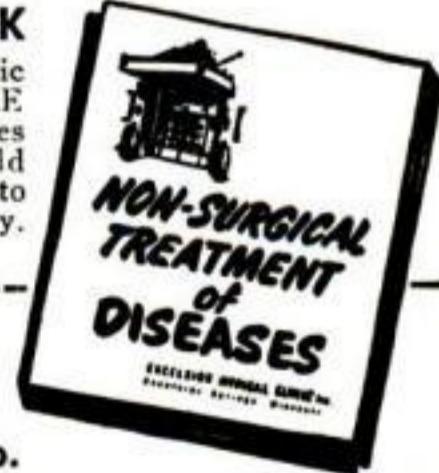
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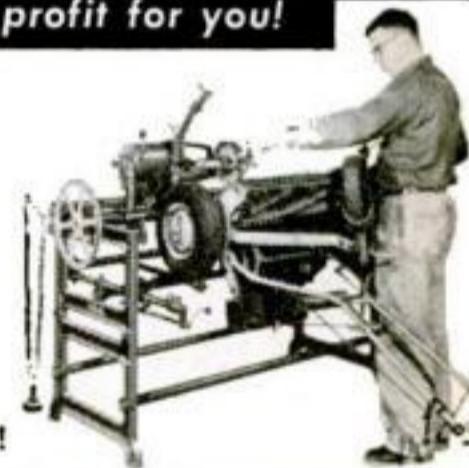
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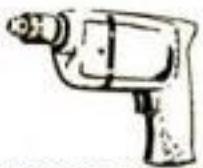
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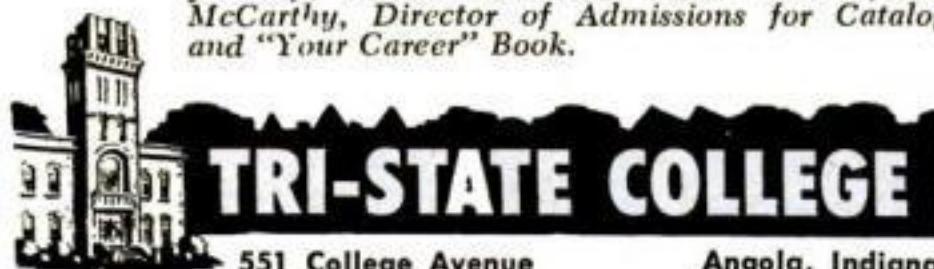
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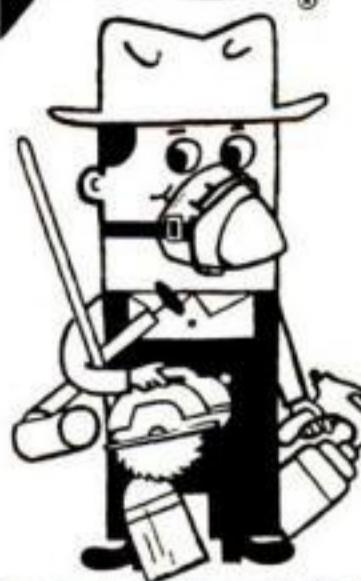
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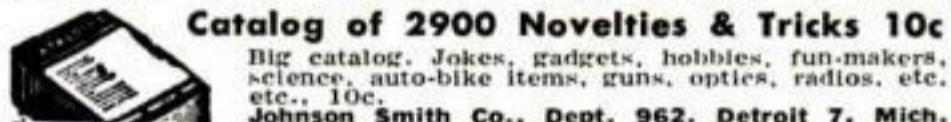
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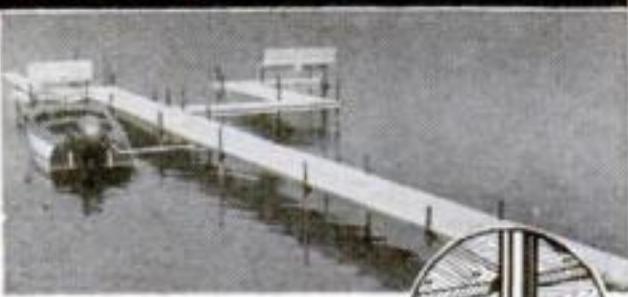
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We give you handiest hunting and fishing knife you've ever had! Has 4-INCH LONG highly tempered steel blade—VERY SHARP! Attractive handle. We send knife FREE to acquaint you with our below-wholesale bargains. Please send 25¢ for handling. NO LIMIT—but send 25¢ handling for each knife. Order TODAY!
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Shrinks Hemorrhoids New Way Without Surgery Stops Itch - Relieves Pain

For the first time science has found a new healing substance with the astonishing ability to shrink hemorrhoids and to relieve pain — without surgery.

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The secret is a new healing substance (Bio-Dyne®) — discovery of a world-famous research institute.

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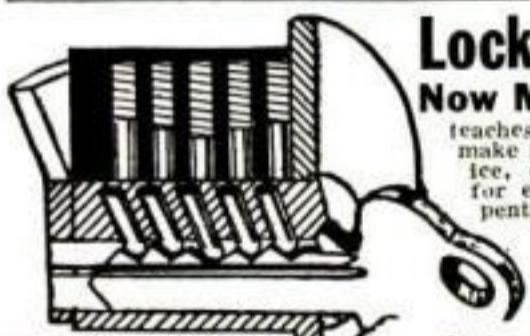
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DETROIT REPORT

By Devon Francis

Safety At Cost

THE presence in President Kennedy's cabinet of a man dedicated to cutting the awesome toll of traffic accidents on U. S. streets and highways may go a long way toward making seat belts available to the car owner—at cost.

All the auto makers have announced that floor anchorages for belts will be installed free of charge in 1962 cars. That is the first step toward encouraging the wider use of belts.

That new Volkswagen. Say you saw this first in POPULAR SCIENCE: The new outsize VW announced for European sale (only) next fall will have an air-cooled engine. But what will drive the blower

The second step will be to urge all dealers—since belts are always a dealer installation—to supply the belts at cost. This poses a problem. With labor rates the same in any given community, belts would retail at the same price. Automobile dealers already bear welts from attacks by the Justice Department for price collusion.

Here's where the cabinet member comes in. He's Abraham Ribicoff, former Governor of Connecticut and now Secretary of Health, Education, and Welfare. In talks with Detroit manufacturers before he joined the Kennedy cabinet, he displayed a lively interest in seat belts. Detroit is counting on him to ask Attorney General Robert Kennedy to go easy on the price-collusion angle of seat belts.

Year's weirdest coincidence. R. O. Statum of Fort Worth, Tex., has a house that was built in 1941. Lately he

fan? Not a belt. One of the company's best-kept secrets is how it has managed to cool its engine without resort to a fan belt. Look for the answer before summer's heat is gone.

bought a new Rambler. To his amazement, the ignition key of his car fits the front door of his house.



How Indy tires keep their air. Ever wonder what happens to a tire valve under centrifugal force when cars streak

around the track at the Indianapolis 500-mile Memorial Day race? The valve spring begins depressing at about 150 m.p.h. To keep tires from losing air, the Schrader valve people—who have supplied valves to Indianapolis racers since 1911—manufacture an airtight cap that is screwed on the threads at a torque pressure of 30 pound-inches.

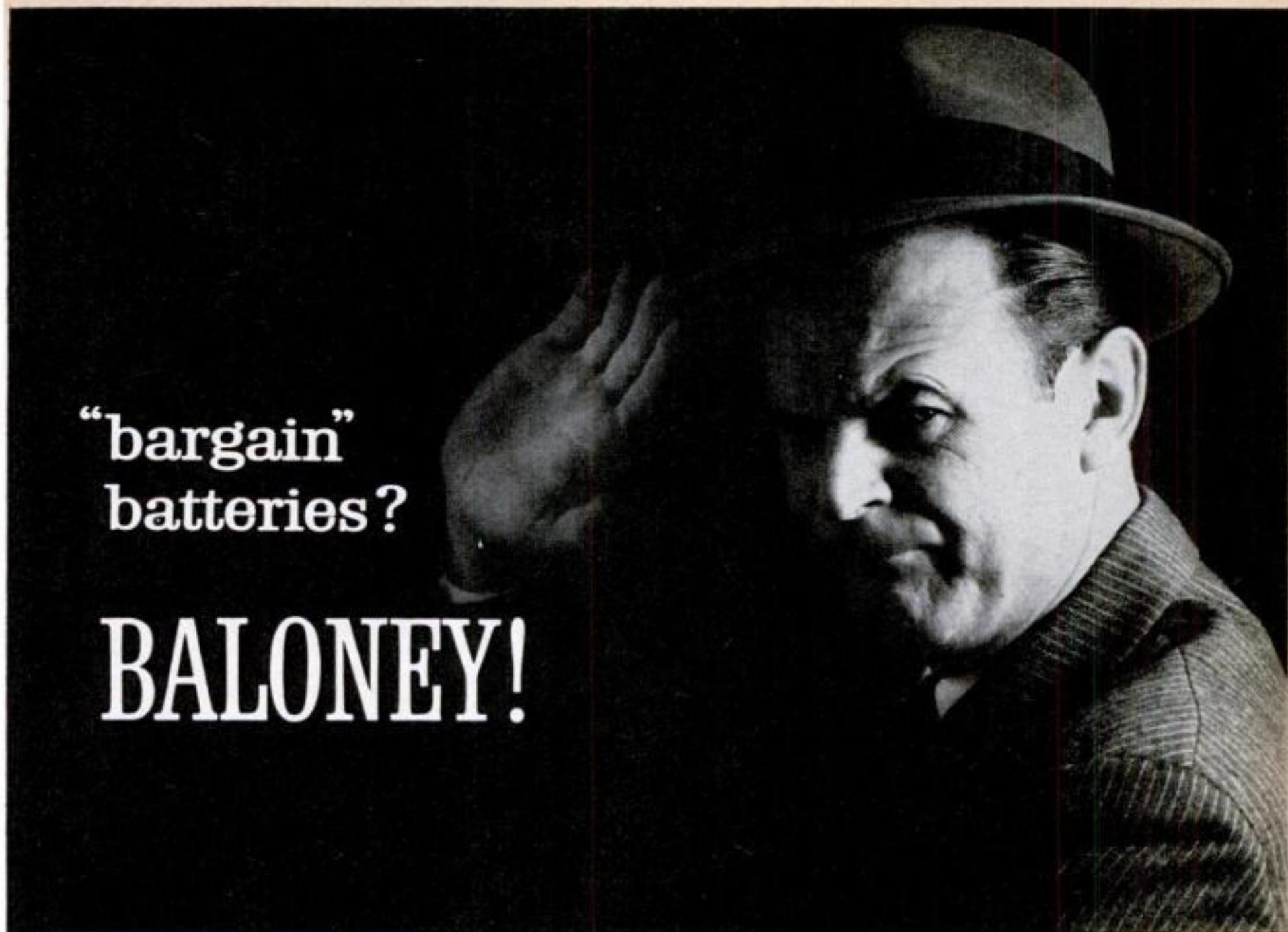
Chevy's rear-engined racer. The CERV-1, an experimental single-seater with a lightweight Corvette V-8 mounted in the rear, rolled out of the Chevrolet Engineering Center not long ago. With it came repeated assurances that it's just a high-performance testbed for future production-car parts, and definitely not a sign that Chevy plans to get into racing.

Developed under the supervision of Zora Arkus-Duntov, the CERV-1's engine

weighs just 350 pounds, matching the 350 hp. it puts out. Aluminum alloys are used for block, heads, water-pump casing, starter-motor body, flywheel, and clutch pressure plate.

Perhaps significantly, the block has no cylinder sleeves; the cylinder bores are specially hardened aluminum.

The one-of-a-kind test car has a 125-pound tubular frame and an 85-pound fiber-glass body.



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batteries?**

BALONEY!

That "cheapie" battery price tag may look great now . . . but it could mean trouble! For a little more, a sure-starting Delco DC-12 can save you lost wages, inconvenience, embarrassment.

DELCO IS DRY CHARGE . . . 100% FRESH!

You get all the power you pay for with a Delco DC-12. No power loss on the shelf . . . it's dry 'til you buy. The dealer adds activator fluid and then it's 100% fresh, ready for work . . . with extra reserve power for the high compression engines and electrical accessories on today's cars.

DELCO GIVES YOU QUALITY FEATURES

Here's your best battery buy! Hard rubber case is durable, resists heat distortion. Extra fluid capacity for fewer refills, less danger of low fluid level. Balanced-gravity, all-season fluid for top battery power at any temperature. These and other features make Delco the true bargain!

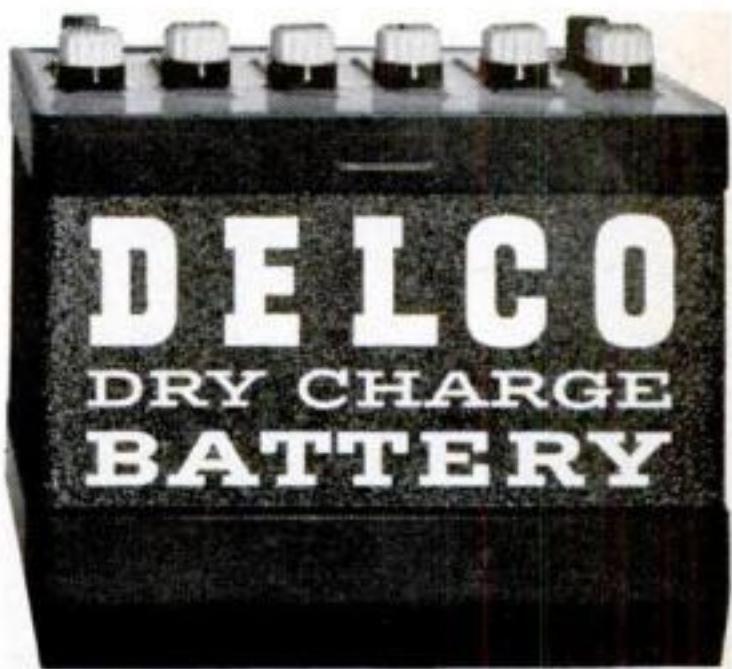
DEALERS CONVENIENTLY NEAR YOU

Your local Delco dealer appreciates your service business. He knows your driving needs, will

specify the right Delco for them. And automotive service is his specialty, not his sideline!

FOR SURE STARTS . . . DELCO DC-12!

For dependable, year round starting, you can't do better than a 100% fresh Delco Dry Charge. Delco is original equipment on more new cars than any other battery, first choice for replacement, too. Get a battery check from your Delco dealer soon. If replacement is indicated, make it a Delco DC-12!



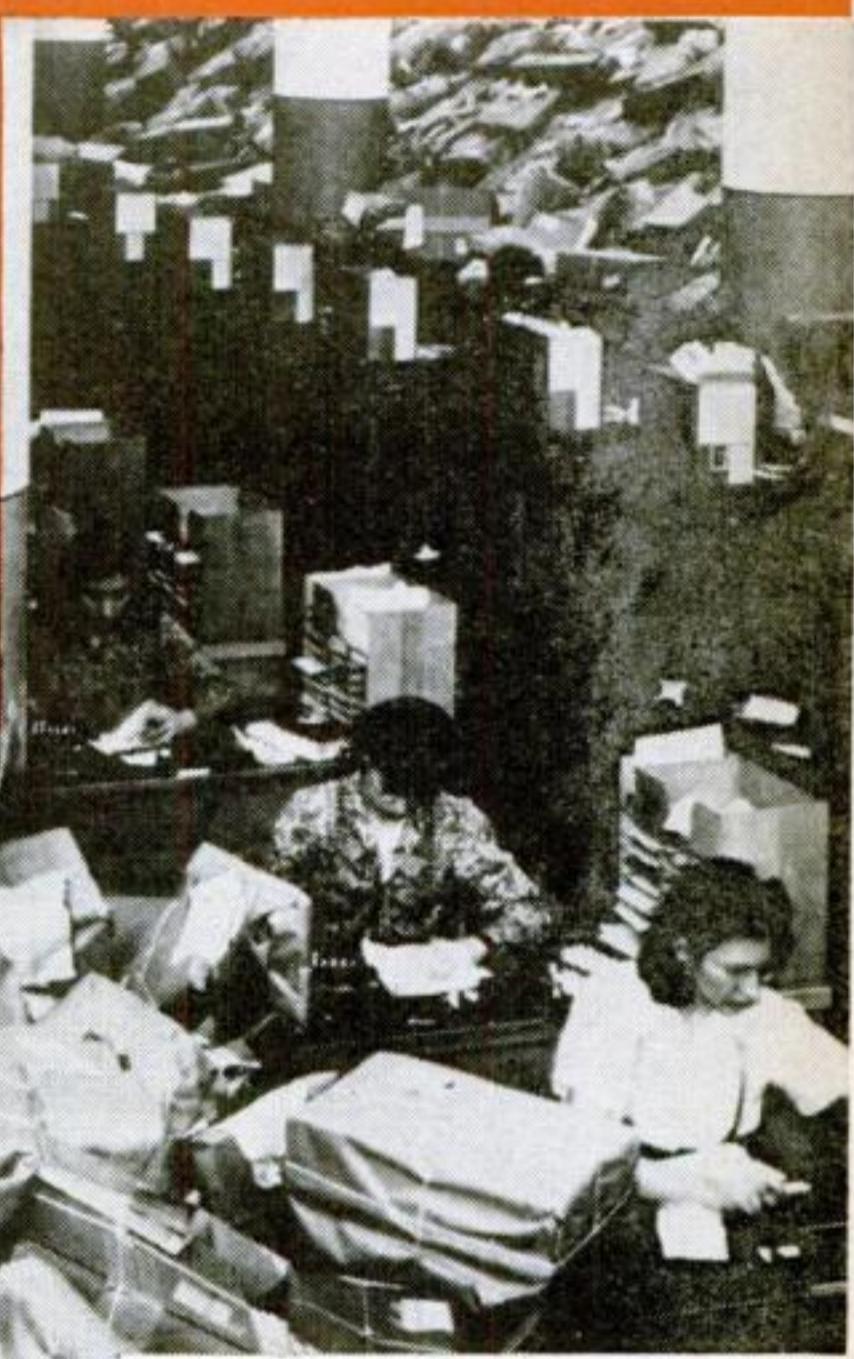
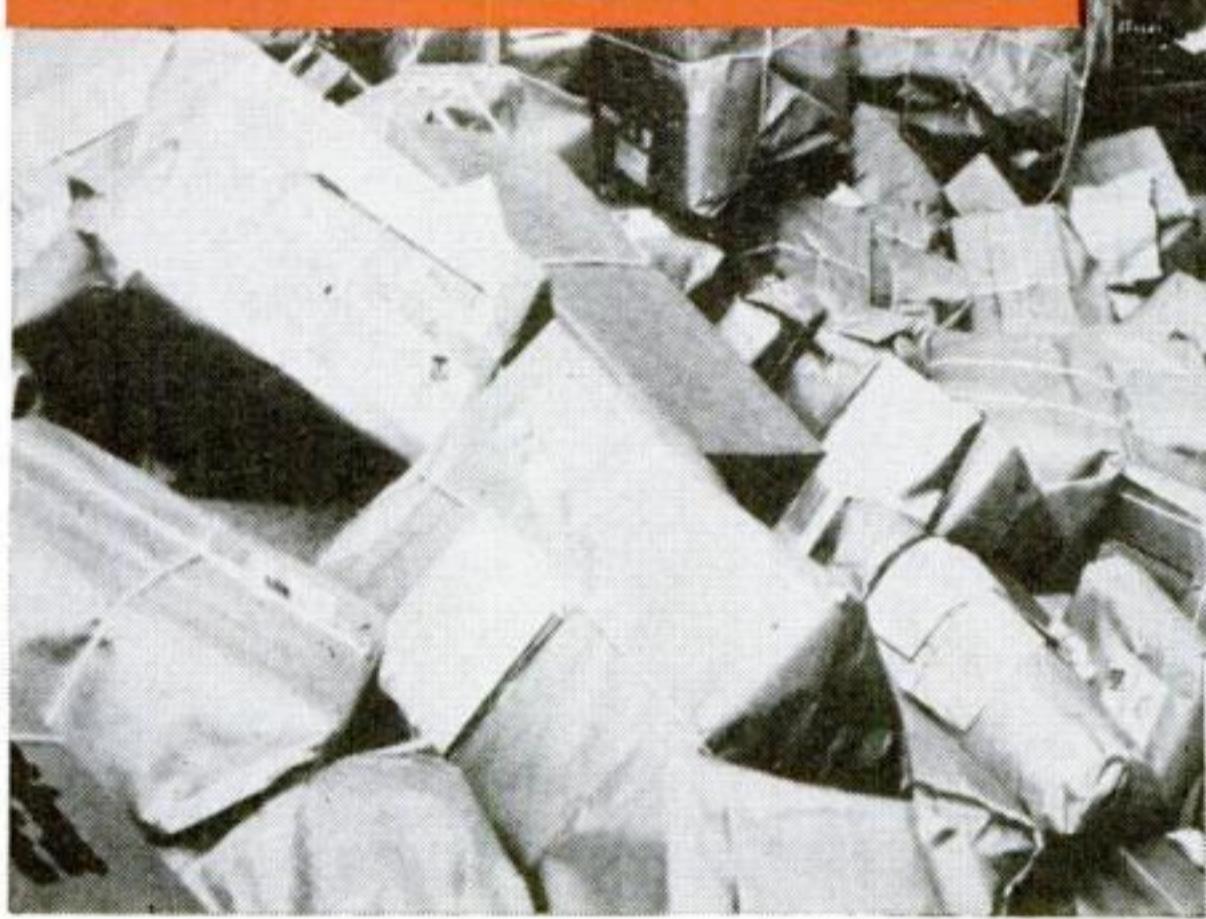
DELCO...“A GOOD NAME FOR GOOD SERVICE!”

*Another reliable
General Motors product,
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A number of one-man mail order enterprises are paying their owners an income of \$40,000 to \$50,000.

SPECIAL OPPORTUNITIES



Mail order is big business. Annual catalog sales volume of Sears, Roebuck and Co. is over 700 million dollars!

HOW TO START

Your Own Mail Order Business

You can make a fortune by mail. New firms will set you up in a fabulous mail order business of your own! They'll make up your catalogs, prepare your advertising, supply mailing lists and even ship your products for you!

By Robert Stephenson

When Anthony Sambati injured his back and was laid off from work he never dreamed it would be a blessing in disguise. Bedridden for weeks, he decided to start a small mail order business. This was something he could run right from his own home and required very little capital to begin. In fact, Sambati started with less than \$85.00.



After a short time in mail order, Sambati soon had a beautiful home with all the luxuries of a successful businessman.

He figured that a small mail order business might provide a temporary income to support his family until he got back on his feet. His first step was to obtain a franchise from a large wholesale mail order firm which supplied him with all the necessary catalogs and mailing literature. It wasn't long until his spare-time venture blossomed into a booming enterprise. Drawing a small salary and pouring the rest of the profits back into the business, he soon had others working for him! Today he owns a large retail store, his own warehouse and a beautiful home with all the luxuries of a successful businessman.

Sambati's story is typical of a number of men and women who began a small mail order business with absolutely no previous experience, and made a huge success of it. These 'little' people are quietly pocketing big profits every day—many content to keep the business small . . . spending an hour or two each day in the privacy of their own home. No bosses, time clocks or small pay envelopes. No door to door selling, in fact, you never even meet your customers face to face.

Yes, a small one-man mail order business is ideal for anyone wanting a chance to gain financial security and independence. Yet thousands try mail order each year and fail, simply because they don't learn the few simple secrets of success early in the game.

Take the case of Bud Sheer who had been working for a theatre in a small New Jersey town. With only a few hours spare-time to spend each morning, he tried mail order to supplement his regular income. Like many beginners in this field, Sheer was faced with the problem of finding good mail order items which would have a high mark-up and repeat sales potential. But the biggest obstacle was the expense of printing a catalog.

Then he heard about the A. J. Statile Co. of Ridgefield Park, New Jersey—an organization set up to aid the small mail order beginner.

He wrote to A. J. Statile Co. for full information, sent in his application for a franchise and within a short time the cash began rolling in. Today Bud Sheer owns the theatre he once worked for. Sheer attributes his success in mail order to the A. J. Statile Co. Actually, the theatre he owns has become a side investment.

He still uses the beautiful 300 page mail order catalogs supplied by A. J. Statile Co.

How does the Statile Co. help the beginner get a sound start in mail order? Very simply. Just as Henry Ford made automobiles within the reach of the general public—by mass production and large volume.

Let's take a few specific examples:

(1) All franchised dealers of A. J. Statile are offered ready to mail catalogs and sales literature. Each mailing piece has the dealer's name and address printed right on it. By printing millions of catalogs, Statile is able to offer these at a fraction of their regular cost. The artwork and layout costs for these catalogs would run into thousands of dollars for the beginner if he were starting from 'scratch'.

(2) Since all mailing material and catalogs contain your name and address, all orders come directly to you. Yet you don't have to invest one penny in inventory. All merchandise is stocked for you. In fact Statile has over \$3 million dollars worth of mail order merchandise at your disposal.

(3) All packaging and shipping is done for you. You simply send a shipping label to Statile together with the wholesale cost of the items, and the merchandise is shipped directly to your customers under your own shipping label.

(4) A consultation service is provided to answer any questions you may have. You receive a secret list of over 100 national magazines which run free ads. You'll be shown how to obtain free publicity on your own mail order items. In addition, you obtain trade names and addresses of over 150 other mail order wholesalers who drop-ship top mail order items for you. You'll also be given all the government laws and regulations pertaining to a home operated mail order business. These laws are a 'must' for all beginners.

All this valuable information is covered in the Statile Mail Order Survey which every new franchised dealer receives from Statile before they begin. Formerly sold for \$25.00, this survey has become the 'bible' of the trade. Mr. J. M. of Baltimore, Md., writes, "To tell the truth, all the information in regard to obtaining free ads is alone worth the \$25.00 I paid you . . ." J. D. of Kalamazoo, Mich.,

states, "Just a personal note to say I am most satisfied with my \$25.00 investment. Your sales plan is simple and well organized . . ." These are only a few of the many testimonials received praising the Statile Mail Order Survey.

(5) The catalogs and mailing literature offered by Statile Co. cover every conceivable mail order item. You select the field you are interested in . . . BABY ITEMS, TOYS, APPLIANCES, VITAMINS, BOOKLETS AND



The thrill of receiving money in your morning mail is one you'll never tire of.

MAIL ORDER COURSES, you name it, Statile has the catalog or mailing piece. Select your market, order your mailing literature and you're in business.

(6) You'll be told how to compile your own mailing lists—and this is the most important part of your business. Many a beginner has fallen by the wayside simply because he mails his catalogs to a poor list of names. Suppose, for example, you offered a beautiful scale model of a 40' Chris-Craft cabin cruiser by mail. You would probably make your mailings to boating enthusiasts and the chances are that nine times out of ten your mailings would show a loss instead of a profit. How would Statile help you solve this particular mailing list problem? He would show you where to get the names and addresses of *actual owners* of 40 foot Chris-Craft cabin cruisers! Surely every owner would like to have a scale model of his own boat. Strange as it may seem, such a mailing list is available to anyone. The secret is where to find it. This is just one example of how an experienced mail order expert giving you personal advice, may mean the difference between success and failure!

This same method of obtaining selective specialized mailing lists may be applied to practically any market . . . selling baby items to new mothers, selling toys to young children, etc., etc.

So much for starting your own mail order business. Now, a word of caution. OBTAIN YOUR MAIL ORDER FRANCHISE FROM A

REPUTABLE MAIL ORDER FIRM. Unfortunately, during the past few years a number of ads have appeared in newspapers and magazines offering to start people in mail order. The ads are grossly misleading. Many imply that you can become a millionaire over night if you use their catalogs. Beware! Particularly if they operate their own mail order business direct to the consumer. These firms compete with their own franchised dealers! They could just as well mail all the catalogs themselves. They don't need you.

Other shady firms fail to drop-ship your orders promptly, thereby losing customers for you. In mail order, prompt shipment is an absolute requirement for a successful operation.

Deal only with firms whose business is preparing catalogs and shipping merchandise. They operate on a strict wholesale basis for franchised dealers exclusively. Such a firm is the A. J. Statile Co. Letters from successful franchised mail order dealers speak for themselves. A woman from Milwaukee writes, "It has been better than my expectations." A gentleman from California states "we are quite pleased with the response we are receiving." Another man from Wisconsin writes, "To say the least, I am more than satisfied."

Yes, a small mail order business offers you an opportunity to earn a second income, or—if you work at it in earnest, a chance to strike it rich. The young housewife in St. Louis may be content to make an extra \$20.00 a week . . . the office worker in Los Angeles may be aiming for \$150.00 weekly full time business . . . and the ambitious schoolteacher in Newark may reach \$20,000.00 a year. What is your objective? Set your own goal, pick your own hours, and the sky is the limit.

Even a government report stated that a number of the most successful one-man mail order enterprises make as high as \$40,000 to



Big firms will carry all stock for you. They ship orders direct to your customers using your own shipping labels.

Your Own Catalogs of Top Mail Order Items!



• NAME BRAND
GIFTS, BABY ITEMS

• CATALOGS OF TOYS,
MERCHANDISE

• CORRESPONDENCE
COURSES

A. J. Statile Co. will prepare your catalogs, write your sales letters, supply mailing lists and even ship merchandise for you, using your own shipping labels!

\$50,000 a year! But frankly, this is the exception rather than the rule. Most mail order operators are content to earn a comfortable living doing little physical work, but enjoying their work thoroughly! We don't say you'll be a mail order millionaire or another Sears & Roebuck, but if you're looking for a business of your own with financial security, the answer is mail order. If you've already tried mail order with little or no success, don't give up! Try to analyze what went wrong. Success comes only to those who keep trying and learn from their own mistakes. Again we emphasize, deal only with a reputable firm.

The A. J. Statile Co. has been in business for over twelve years. They are members of

the Ridgefield Park Chamber of Commerce. They gladly furnish bank or trade references upon request. They are probably one of the largest mail order wholesalers in the country. Whether it be toys, gifts, vitamins or appliances—they've got it ready to ship under your label **WITHIN 24 HOURS!**

Firmly convinced that no other business offers the tremendous opportunities of mail order, A. J. Statile, president of the firm, is an outspoken advocate of the man or woman who wants to start in business for himself. As Statile puts it, "by all means, start your own business and start NOW! If you want a chance at security and financial independence make your choice mail order. There's nothing like it. Absolutely nothing!"

FOR FREE DETAILS

----- **Mail coupon below — no obligation** -----

A. J. Statile Co., Dept. 17 • Statile Building • Ridgefield Park 17, N. J.

Dear Mr. Statile:

Please send me complete FREE details telling me how I may obtain a franchised mail order dealership with your firm. I understand I am under no obligation and no salesman will call on me.

NAME..... AGE..... SEX.....

ADDRESS

CITY..... ZONE..... STATE.....

PREVIOUS EXPERIENCE, IF ANY.....

What is the one real difference between these identical Vitamins



Each Capsule Contains:

Vitamin A 25,000 U.S.P. units
 Vitamin D 1,000 U.S.P. units
 Thiamin Mononitrate (B-1)....10 mg.
 Riboflavin (B-2) 10 mg.
 Niacinamide 100 mg.
 Ascorbic Acid (C) 200 mg.
 Pyridoxine HCL (B6) 5 mg.
 d-Calcium Pantothenate 20 mg.
 Vitamin B-12 Activity 5 meg.

ADAVITE — 100 capsules — \$3.25

Each Capsule Contains:

Vitamin A 25,000 U.S.P. units
 Vitamin D 1,000 U.S.P. units
 Thiamin Mononitrate (B-1)....10 mg.
 Riboflavin (B-2) 10 mg.
 Niacinamide 100 mg.
 Ascorbic Acid (C) 200 mg.
 Pyridoxine HCL (B6) 5 mg.
 d-Calcium Pantothenate 20 mg.
 Vitamin B-12 Activity 5 meg.

Brand X — 100 capsules — \$9.45

Price, and price alone, is the only real difference!

Brand X, and others like it, sell for an average price of \$9.45 per hundred. But the identical formula, under the name Adavite, ordered direct from the Hudson Vitamin Catalog, is just \$3.25.

And yet, despite the great variance in vitamin prices, there are no grades of vitamins. The brand X formula and the Hudson formula have the same potency and effectiveness. Both meet the same strict government standards.

How then is it possible for you to save over \$6.00 per hundred on this particular formula?

Savings of up to 50% and more on over 100 nationally recognized Hudson Vitamin

formulas are possible because now you can buy your family vitamins DIRECT.

Doctors and nurses have recognized this fact and have been ordering their vitamins direct from Hudson for more than 25 years.

THE HUDSON CATALOG IS AVAILABLE TO YOU FREE, JUST USE THE COUPON BELOW.

This is only one example—why not check ALL the values—write for the Catalog and show it to your doctor if you like—but, discover for yourself why HUDSON has become a DIRECT source for vitamins throughout the nation. No salesmen will call. All Hudson vitamin products are sold with a money-back guarantee.

HUDSON VITAMIN PRODUCTS, INC.

89 Seventh Avenue, Dept. M-894, New York 11, N. Y.

Please mail this coupon today!



HUDSON VITAMIN PRODUCTS, INC., Dept. M-894
 89 Seventh Avenue, New York 11, N. Y.

Please mail me your Free Hudson Vitamin Catalog.

NAME _____

ADDRESS _____

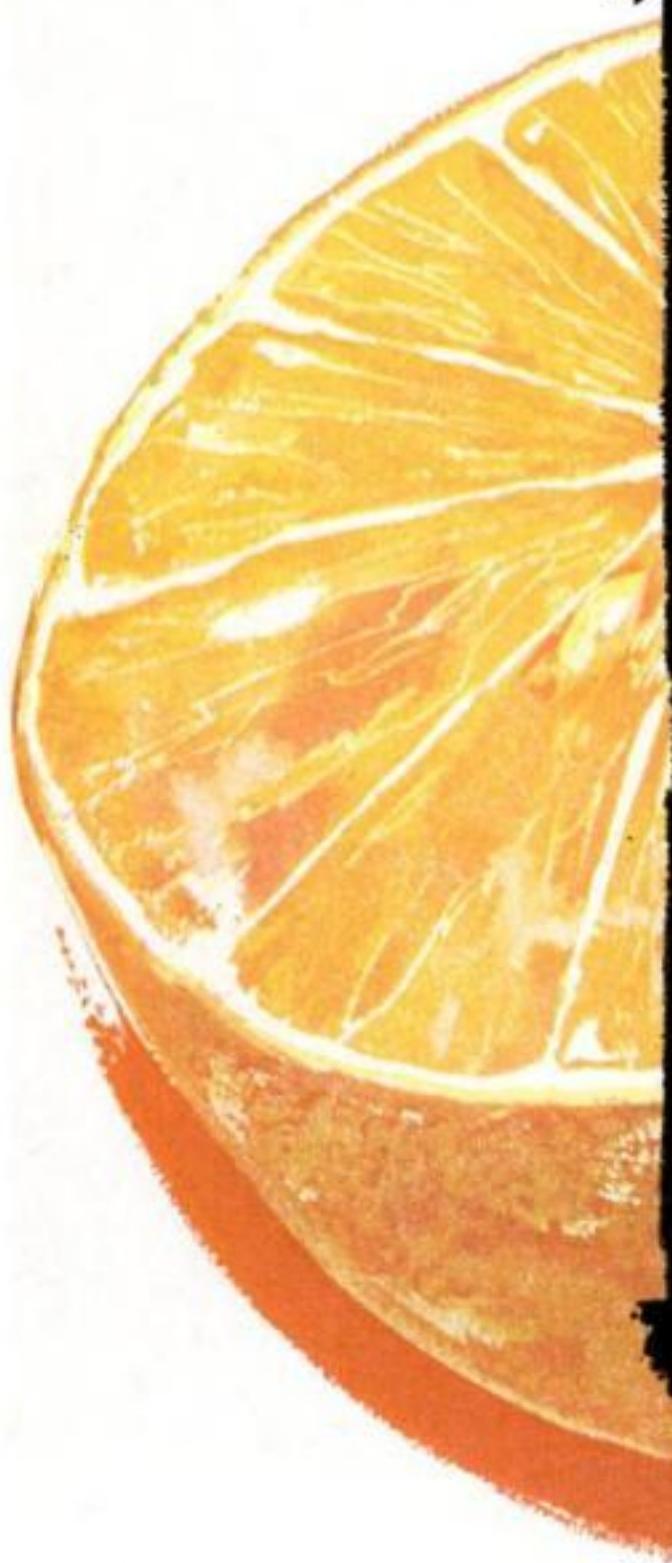
CITY _____ ZONE _____ STATE _____

Hudson Vitamins have been awarded both the PARENTS' MAGAZINE COMMENDATION SEAL and MCCALL'S USE-TESTED SEAL

Taste PALL MALL...

so GOOD!
GOOD!
GOOD!

You can light
either end!



Good-looking, Good-tasting, Good-smoking Pall Mall!



Why does Pall Mall taste so good, good, good? Because Pall Mall's famous length of fine, good-tasting tobacco travels and gentles the smoke naturally—makes it mild—but does not filter out that satisfying flavor. That's why Pall Mall tastes so good! good! good! Never too strong. Never too weak. Always just right!



HERE'S WHY SMOKE "TRAVELED" THROUGH FINE TOBACCO TASTES BEST

- 1 You get Pall Mall's famous length of the finest tobaccos money can buy.
- 2 Pall Mall's famous length travels and gentles the smoke naturally. Travels it ...
- 3 Over, under, around and through Pall Mall's fine, good-tasting tobaccos—and makes it mild!

Outstanding...and they are Mild!

Enjoy satisfying flavor...so friendly to your taste!

With billions in auto insurance as the tempting target, the phony-accident racket is spreading . . . Here's what to watch for

**POPULAR
SCIENCE**
REG. U. S. PAT. OFF. Monthly



By E.D. Fales Jr.

ON A busy road in Missouri not long ago two men and a woman stopped their Plymouth right in the path of an oncoming truck, were hit and hurled off the road. They'd planned it that way—to collect insurance.

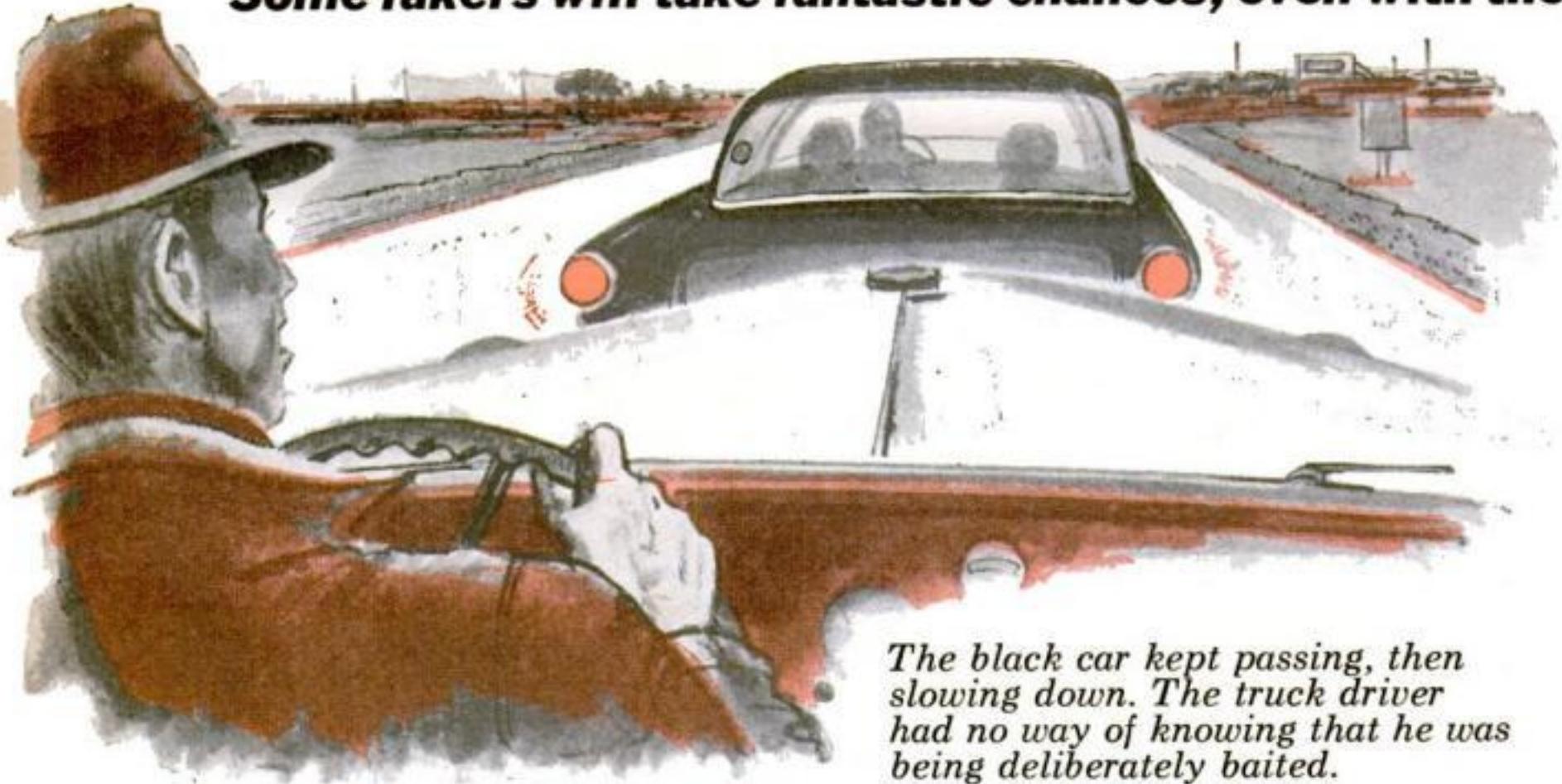
In New England a man developed the vicious habit of driving around traffic circles waiting for a chance "to have a collision." He'd hit some car a glancing blow, open his door, throw himself out—and sue.

And in New Jersey a driver started backing out of a parking place. He heard

CONTINUED

51

Some fakers will take fantastic chances, even with the



The black car kept passing, then slowing down. The truck driver had no way of knowing that he was being deliberately baited.

a scream, ran back, found a woman lying in the street.

"You hit me!" she cried. She hadn't been hit at all; she'd watched her chance and thrown herself down. She sued for \$100,000, produced an impressive "injury" report, and wound up with a quick settlement.

These are just a few examples of the spectacular young accident-faking racket that a nationwide force of crime investigators—mostly FBI-trained—is trying to blot out before it gets worse. It's something you should know about, for two reasons: (1) injury and damage fakers are partly to blame for the high insurance rates drivers pay in some areas today; and (2) like the truck driver in Missouri, or the motorist in New Jersey, you, too, could easily become a victim.

Most—not all—fakers work in gangs,

some of which have been found to be headed by ex-convicts, crooked body-shop operators, and shady lawyers. Some operate with the help of unethical doctors.

Occasional accident faking first came to notice after World War II, when large amounts of auto insurance began to be written. Today, with \$6,000,000,000 in car policies as a target for criminals,



The accident may be only a slight fender-bender, but the faker claims severe injury, sues for plenty.

The Case of the Couple in the Buick

Grimmest case of accident faking in Claims Bureau files happened in Los Angeles. There, one June day, three men cooked up a weird scheme. A Buick was to be hit by a car and knocked over a cliff. One of the three conspirators and his wife were to be found in it: the wife unconscious, and her husband bleeding, with arms, legs, and even fingers broken.

They would then sue the driver who hit them for \$50,000. But first a driver had to

be found who was insured for that amount and who could be bribed to cooperate.

The gang located a Ford owner who agreed to go along. Then he learned the details. The gang was to pay another outsider \$1,000 to render the woman unconscious by hypodermic injection. The same outsider was to give the husband dope to relieve his pain while his arms, legs, and fingers were smashed with a bat. Just before the battered man and his wife were carried down the cliff to be put inside the smashed Buick, someone, for final realism, was to punch the husband in the nose to make it bleed.

lives of their wives and children

there are more fakers around. In the past two years more than 300 have been convicted and many have gone to jail. How many others got away with their dirty game no one knows.

Finding the fakers is the job of a quiet agency few drivers have ever heard of. Known simply as the "Claims Bureau," it has headquarters in a building in New York's lower Manhattan and is the security arm of 130 U.S. insurance companies. In four years its special agents have flushed out gangs of accident fakers in Akron, Panama City, Fla., Miami, the Camden-Philadelphia area, Walla Walla, Wash., and New York State.

At least one gang had run up a "take" of over \$200,000. The gangs usually have from three to a dozen members, but one super-gang of 60 members is now being investigated in Portland, Ore.

Accident-faking, according to N. Morgan Woods, manager of the Claims Bureau, is done in several ways:

The staged accident. An unsuspecting driver is lured into a minor crash, usually a "rear-ender," and is then sued. The fakers, with much moaning and groaning, demand to be taken to a hospital. Once their names are on the books they make loud complaints about poor service and demand to be released—before hospital doctors can discover they haven't really been hurt. Then they get impressive "injury reports" from their own doctors—and sue.

The magnified accident. You may find yourself in a real accident. It may be only a slight fender-bender. But if there's a faker in the other car he (or she) may claim severe injury and sue for a large

Horrified, the Ford owner secretly went to the Los Angeles police. They couldn't believe his story. He went next to the Los Angeles sheriff's office, which, in turn, got in touch with the insurance company involved. A Claims Bureau agent was put on the job immediately.

The Ford owner was asked to continue to appear to "cooperate" with the plotters. Sheriff's deputies bugged the headquarters of the conspirators and learned that the incredible plot was true.

On the night the "accident" was to take place, the Claims Bureau agent, eight deputies, and two matrons were hidden at the



Entire front ends were removed—and hidden. Smashed bumpers, grilles, radiators, hoods, and headlights were cleverly substituted.

amount—looking for a quick settlement of, say, \$300 to \$1,000.

The sideswipers. Fakers buy two wrecks off a junk heap, repair them just enough to run, then insure them under fake names. Next, the heaps are towed to a country road. When no one is looking a driver gets in each car—and they are run toward each other and smashed together in a deliberate sideswipe.

This cute act, known by the professional fakers as "rubbing," leaves convincing skid marks and wreckage. Police are called, and claims filed. (And your premiums go up another tiny notch.)

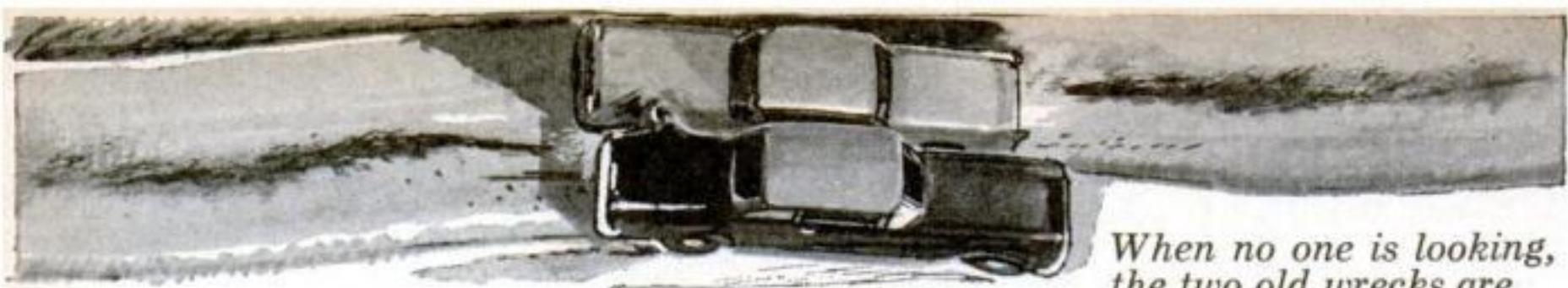
Ghost accidents. Some fakers deal in accidents that happen only on paper. Often these are engineered through fake body shops.

Not long ago, Claims Bureau agents were tipped off to investigate a shop in

scene of the crime. The fakers arrived in several cars and walked into a dark grove of trees to proceed with the bone-breaking. The woman appeared to be already doped.

By a quirk of fate, a Los Angeles police department prowler happened by, saw the group, thought they had discovered a dope ring—and unwittingly broke up what would have been the weirdest fake-accident case on record.

But the investigators had seen and heard enough. The plotters were tried for conspiracy to defraud. Three went to jail. The Ford driver who had informed on them went free.



When no one is looking, the two old wrecks are run toward each other and smashed.

the New York area. They first noted that it worked only on Buicks, Oldsmobiles, and Cadillacs—on which fairly high claims can be made.

A customer would come in for a paint job or minor repairs.

"Look, pal," he'd be told, "we can get that done for you free. But you'll have to say you had an accident. Come back in a week. What's your insurance company's name?"

Agents learned that the operators—a dishonest insurance broker, an appraiser, and a lawyer—were filing dozens of claims in the names of customers, and submitting repair estimates, for accidents that never happened. Two customers, Mr. F and Miss K, might be persuaded to "co-operate" and leave their cars. A report would then go in to Mr. F's insurance company:

"Mr. F's car, blinded by lights, skidded into Miss K's car and later hit Mr. E's car. Estimate to fix Miss K's car: \$2,148.99."

The entire front ends of both cars would then be removed—and hidden. Smashed bumpers, grilles, radiators, lights, fenders, and hoods would be substituted. When the adjustor arrived he

would see two very convincing wrecks.

"Sometimes they even removed the good windshields, put in broken ones, and scattered glass around to make it look good," says Woods.

All this would fool the adjustor, and Mr. F's insurance company would be stuck for the bill.

It took the agents, says Woods, some time to find out where all those matching parts were coming from. "Finally," he says, "we discovered *hundreds* of smashed fenders, radiators, wheels, rear doors, anything you could name, up on a roof—all catalogued by car, year, model, and color." Even broken glass was in this incredible stockpile.

All told, 34 persons, including more than 20 customers, were sentenced when agents and police broke up this operation. The guilty customers included a secretary, a lawyer, and a bank vice president.

Accidents that never happened. Another shop, in the Philadelphia area, worked a different twist. The ringleaders would buy up wrecked '55 cars. Customers would be shown a wreck and offered free paint jobs, tires, or repairs: "If you'll just say you ran into this car."

[Continued on page 198]

What to Look Out for When You Get in an Accident

Here are some suggestions from the Claims Bureau and the Aetna Casualty & Surety Co. Watch out, they say, for:

- 1.** Any driver who tries to harass you on the road—front, rear, or side.
- 2.** Any suspicious circumstance in an accident—even a slight one. Call it to the attention of your insurance man immediately.
- 3.** Any questionable repair "deals" that are proposed to you.
- 4.** Any lawyer (or runner) who suddenly shows up at an accident scene, or in a hospital, seeking to handle your business. Such "ambulance chasers" may attempt to involve you in a false or exaggerated claim.

5. Extra damage to your car after an accident. Some unscrupulous tow men have been found to treat cars roughly—in order to make the damage worse—and even to work them over with sledge hammers. Be sure you know what damage your car sustained. Make a note of it at the time of the accident.

And, says Aetna, make a detailed record, or get a friend to do it for you, at an accident scene.

The written data will keep your memory straight and may guard you against later trumped-up claims. Aetna considers this so important that it now issues detailed "on-the-spot" accident-report forms—with maps—like those the police use. It recommends that these be kept in glove compartments and that you fill one out immediately after an accident.

New VW comes in two styles

The long-rumored big brother to the ubiquitous Volkswagen will make its debut in Germany this September.

The conventional body styling of the new VW-1500 bears no resemblance to the familiar beetle shape of the older model. Chassis design is the same, but the new car has slightly more overhang. Parts are not interchangeable.

Available in both two-door and station-wagon form, the car is powered by a rear-mounted, air-cooled engine. Although the flat four displaces 1,500 cc., it is smaller in overall size than the standard 1,192-cc. Volkswagen engine.

A new assembly line in Wolfsburg, West Germany, will produce the new series. Slanted toward Europe's growing

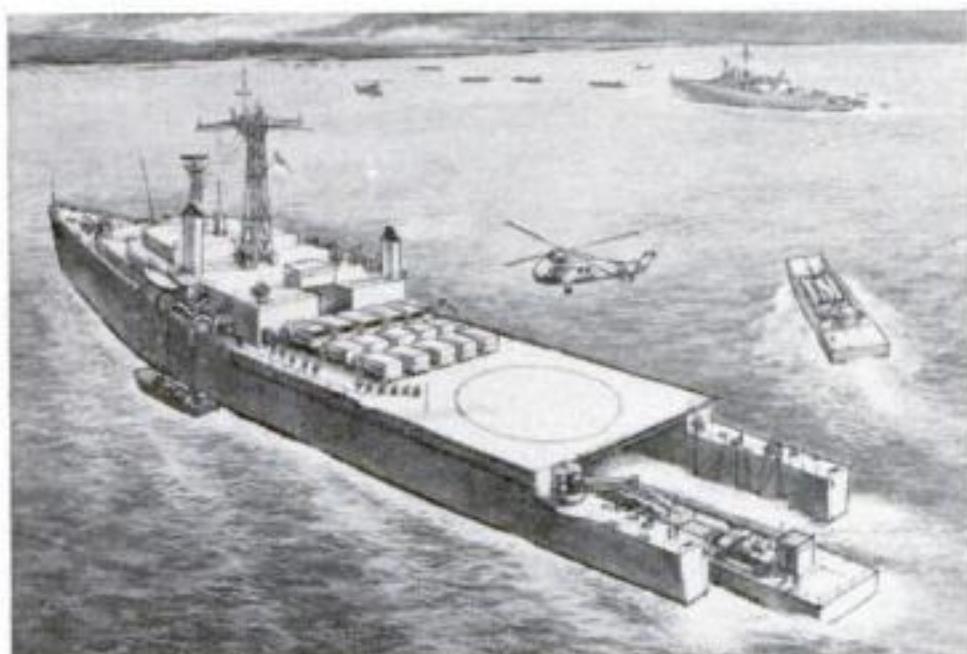


Overall length is 166 inches. Gearbox and engine are integral.



Telltale louvers at rear of station wagon feed air to engine.

middle class, the car supplements the original Volkswagen. Price in Germany will be over \$1,600. At present, no plans have been made for importing the car here.



Floating hornet's nest

An assault ship planned by the British Navy will carry landing craft in her open-end hull. Built like a floating drydock, the mother ship will submerge partially by flooding compartments to let in small craft. She will then hike her brood out of the water by pumping out the ballast, cruise to the assault coast, and re-float the small boats by submerging again. The 15,000-ton ship will carry tanks and supply vehicles, and will have a rear-deck heliport.

Glass blowers keep on blowing

The six musicians at right are glass blowers at a glassworks in Mainz, West Germany. First they blew their trumpets to make them; now they blow them frequently at company concerts, removing them from special cases in which they are kept to avoid breakage.

They say the glass instruments have the same capabilities as metal ones, but produce a cleaner tone.





Converting 154-inch-long enclosed pickup into beach wagon takes 20 minutes and tools above; box-



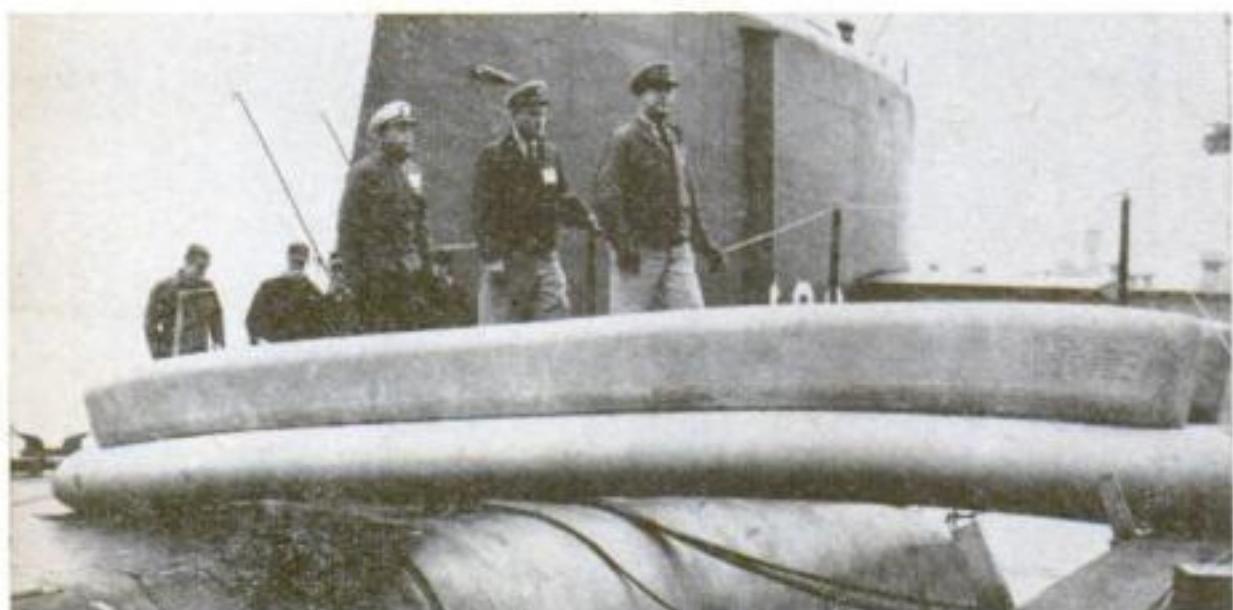
Window frames and windows simply lift out. Windshield drops forward. Optional, extra-cost four-

Stripped pickup becomes beach wagon

Want an automobile with a hard top that will strip down into a beach wagon in practically no time at all? It's here. It will shed its top, windows, and doors with the aid of a few tools to be found on any man's workbench.

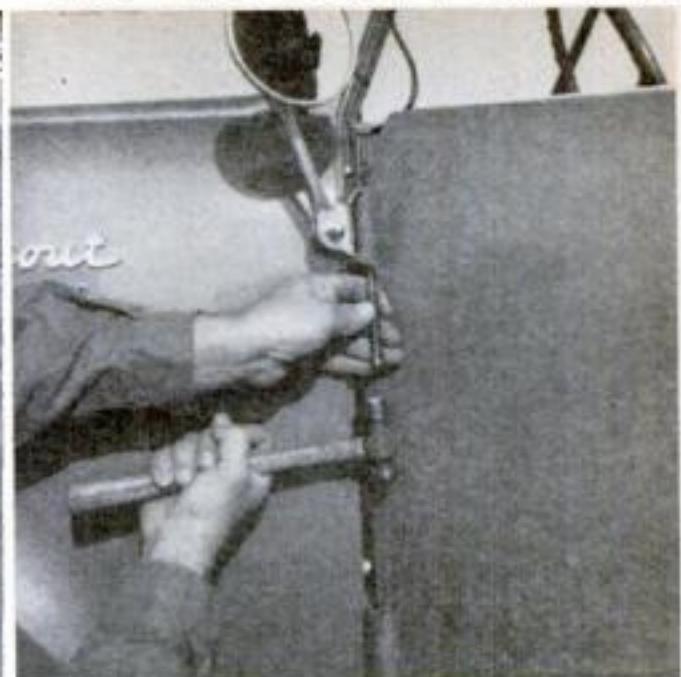
Shown at top as an enclosed pickup, the Scout, just announced by International Harvester, is more than that. It has

many of the characteristics of the famous Willys Jeep, including an optional four-wheel drive. The transfer case that provides power for the front wheels has output shafts that can be tapped for stationary work. The car will push a snow plow or run a winch. The pickup body, with bench seats, is five feet long. The cab seat is 52 inches wide.

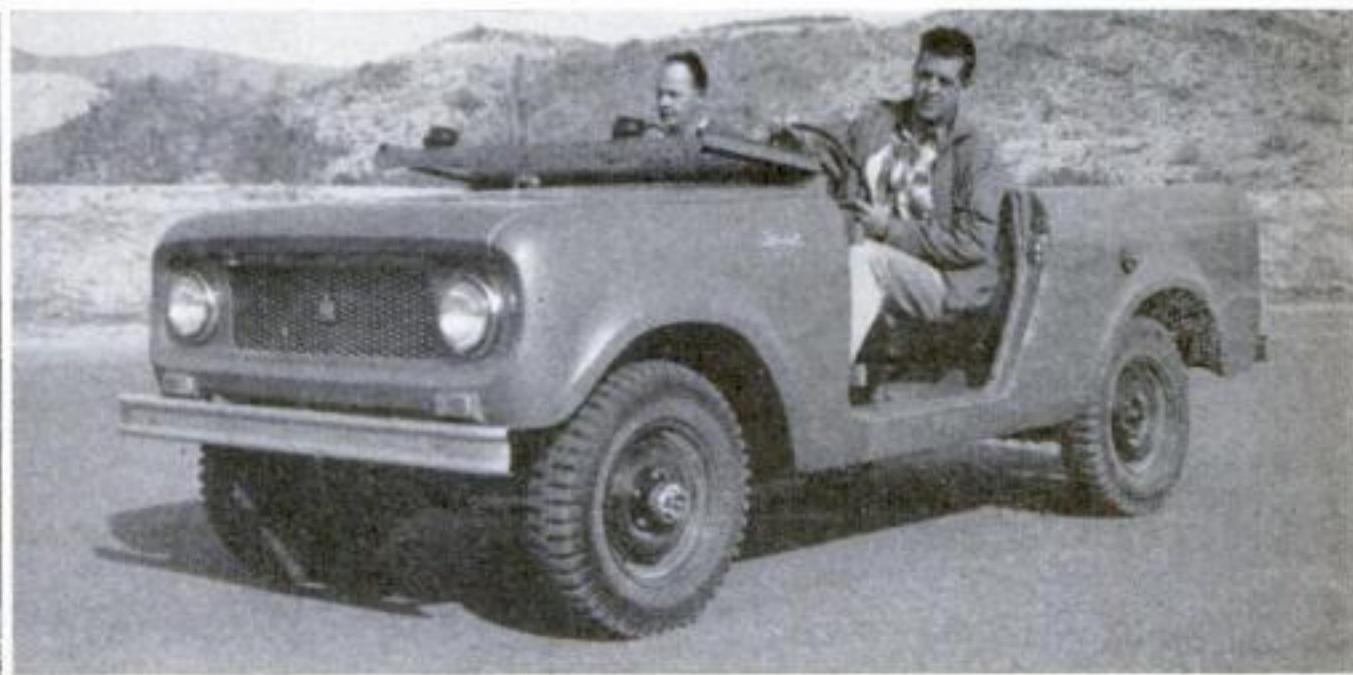


Walking on air

When the nuclear submarine Theodore Roosevelt reaches port, its crew unfolds and inflates this gangplank. The 23-foot boarding platform is made of the same Goodyear inflatable rubberized material from which the sub's 30 bunks are fabricated. It's arched to support a 1,500-pound weight.



end and ratchet wrenches, hammer, punch. Removing 21 nuts and bolts releases the top.



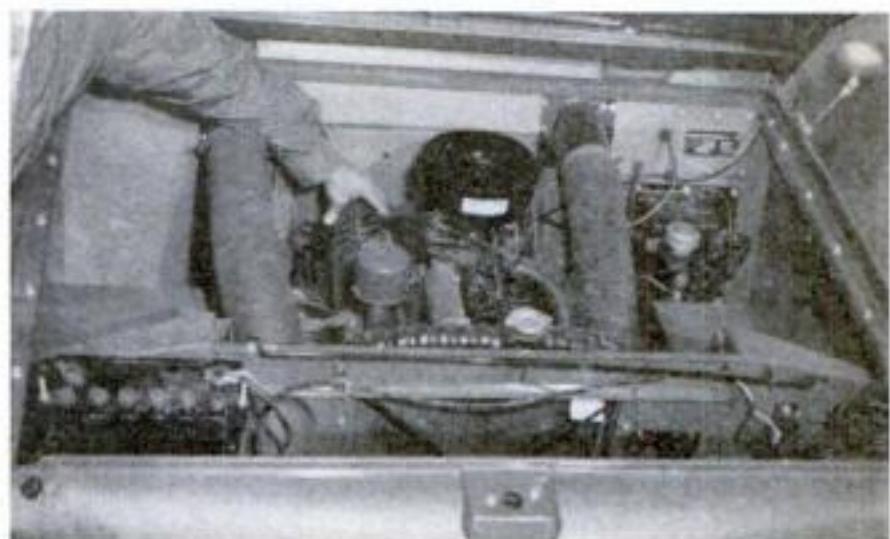
wheel drive is cut in through transfer box by turning the hub lock on each front wheel.

The four-cylinder, 152-cu.-in. engine produces 90 horsepower.

The most interesting innovation is locking hubs. A twist of the wrist engages or disengages the front wheels for highway travel.

Pictures show the Scout with two- and four-wheel drive hubs. Price (stripped): \$1,598 plus taxes, FOB Fort Wayne, Ind.

BUSY LITTLE ENGINE, cylinders slanted to one side, actually is half of a standard V-8.

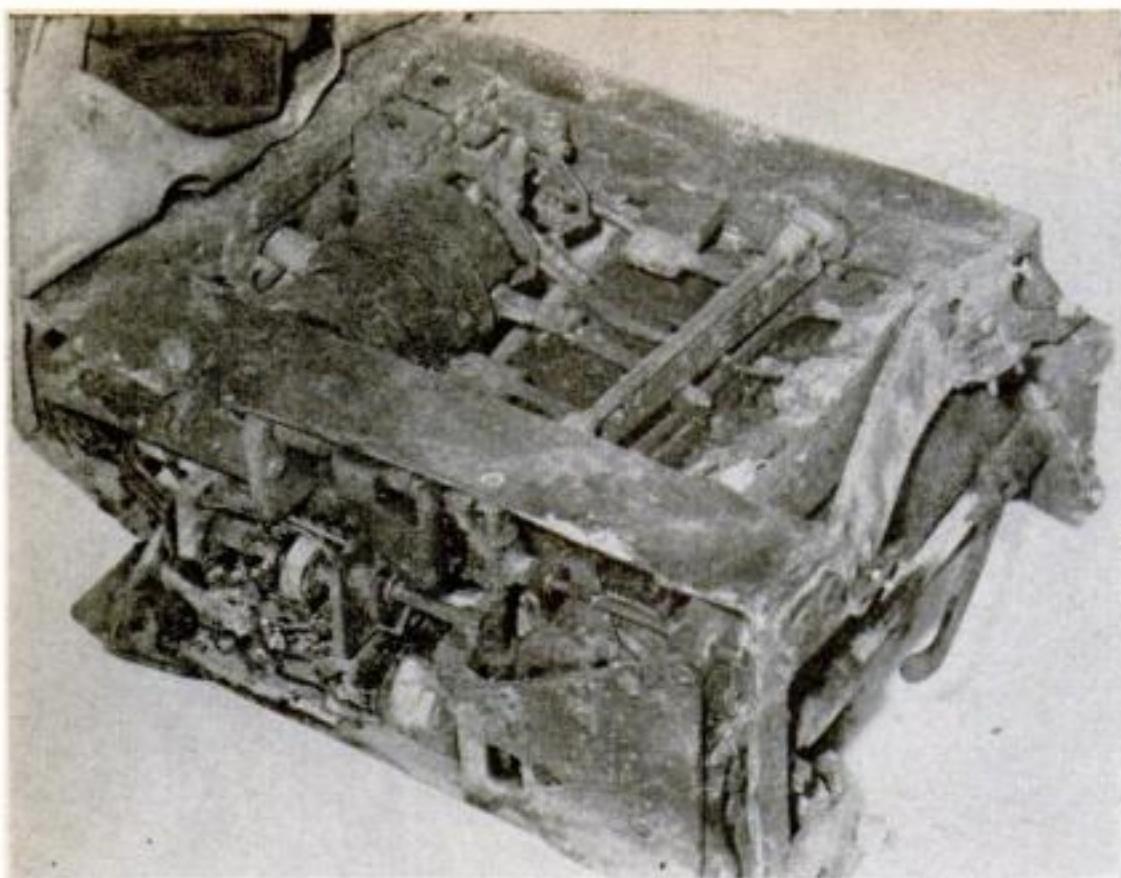


Instant orange juice

The pile of oranges in the photo at right is equivalent to the pound of dehydrated crystals at the center. Add water, and you can fill two half-gallon pitchers with juice containing, the developers say, 96 percent of the vitamin C originally in the fresh fruit.

The crystals are made by Plant Industries, Plant City, Fla., in a 96-ton vacuum dehydrator for military, industrial, and hospital use. You may soon find them on supermarket shelves.





This charred recorder magazine, found at the circled spot at right, gave the facts behind a mid-air collision that hurled a big jet liner into a Brooklyn street

• • • • • • • • • • • • • • • • •

FROM THE RADIO RACK of the DC-8 that collided with a Super Constellation over Staten Island on Dec. 16, 1960, this tape mechanism was thrown by force of impact into basement of church in photo.

It Tells What Dead Men Can't

By Harry Walton

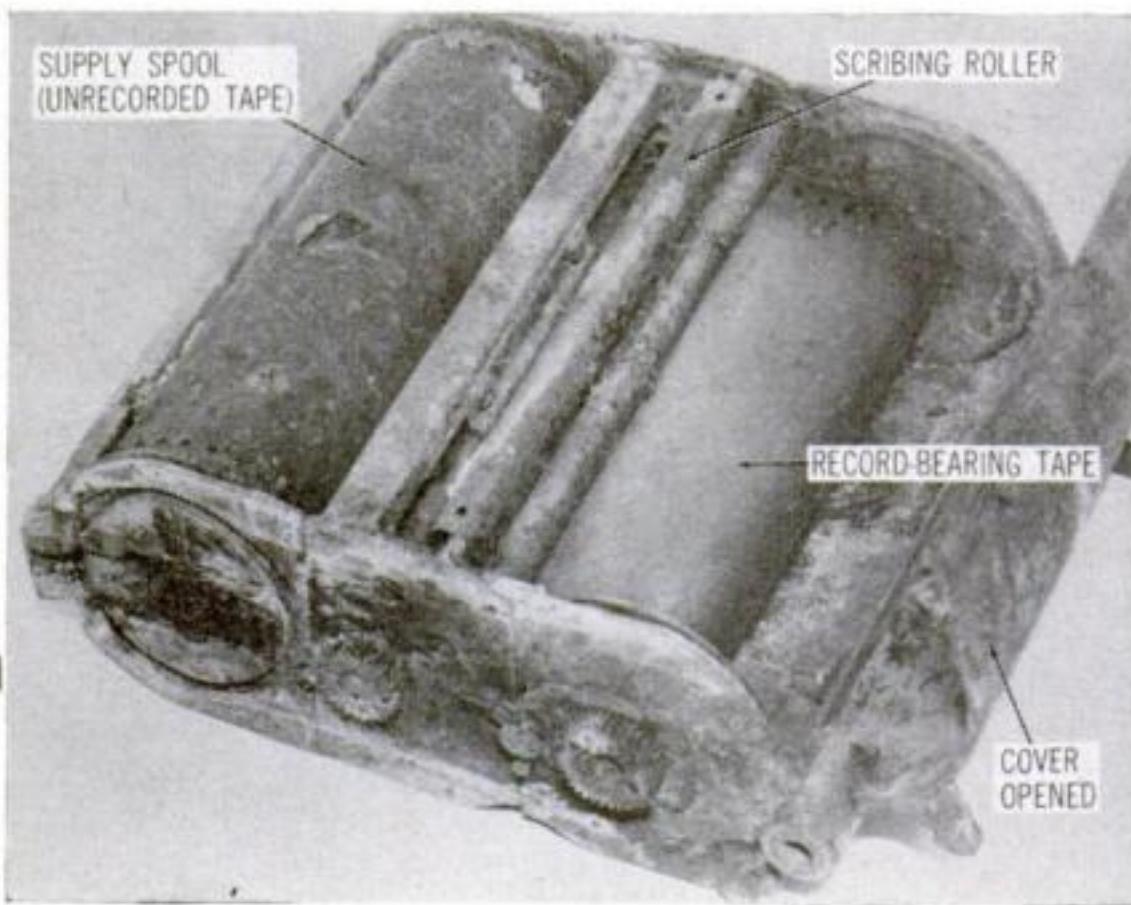
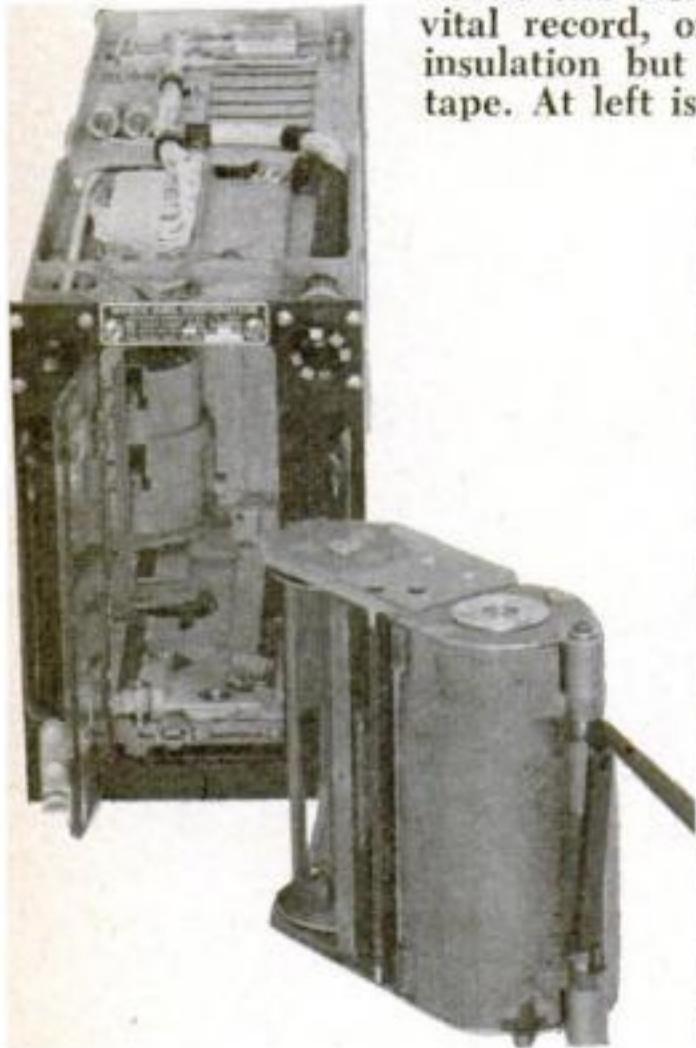
WHY did it happen?

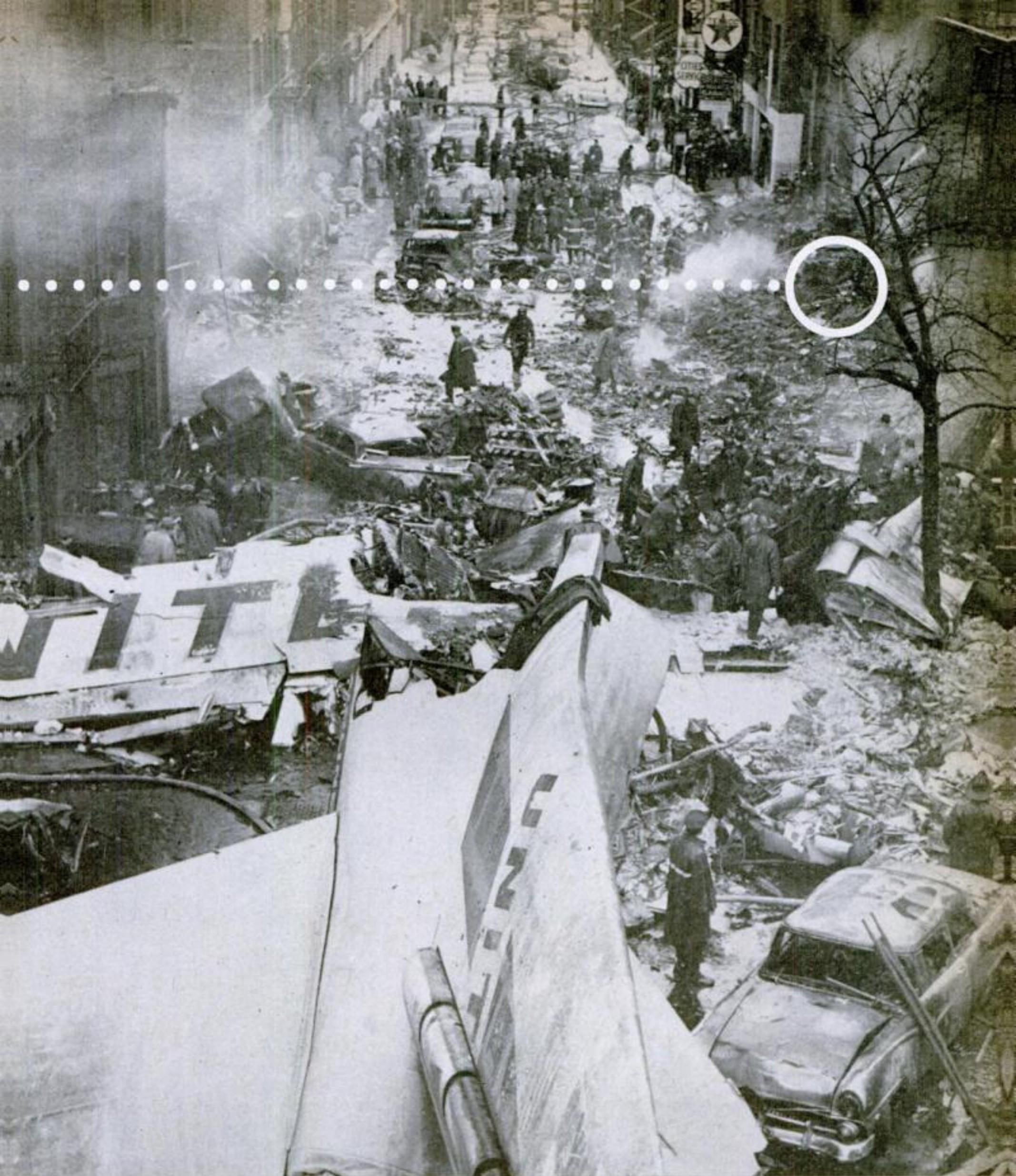
That's the big question following any air disaster. Sometimes experts could answer it if they knew how the plane had been flying before the

trouble. All too often not a living soul can tell.

But an automatic device made aviation history recently. For the first time it gave an accurate record of heading, height, speed, and altitude changes of a plane up to the instant of a mid-air col-

FROM THE ASHES: The tape survived severe fire damage to its case. Its vital record, on take-up spool (below, right), was gummed with burned insulation but readable after cleaning. Only damage was to unrecorded tape. At left is a complete Waste King recorder with its magazine.





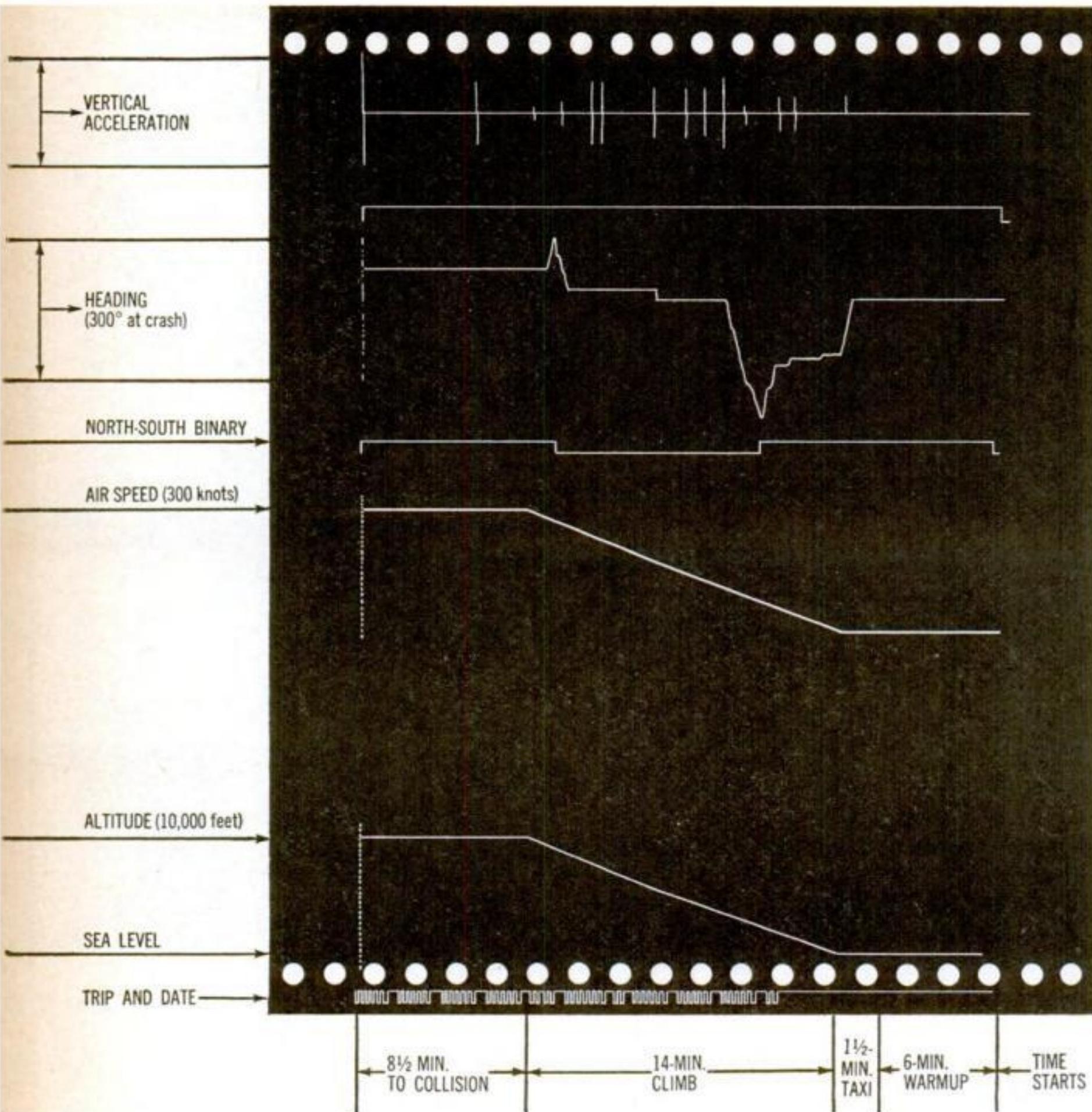
lision. The recorder taken from the wreck of the DC-8 that crashed in a Brooklyn street was badly damaged, but its steel-alloy tape was intact.

Hairlines on that tape, interpreted by the CAB, showed that the plane was doing more than 500 m.p.h. past the

point at which it should have been circling, that it was then 3,700 feet higher than its assigned holding level but losing altitude at 3,600 feet per minute. The recorder showed that at the instant of collision, speed had been cut to 363 m.p.h. and altitude to 5,200 feet, and that the

CONTINUED

How engraved data looks on the Waste King tape



TRAGEDY ON TAPE: The actual record found at the Brooklyn crash scene is still unreleased, but here, full size, is what a section of tape of the same kind might look like after an air collision. Read the sequence from right to left. All events in vertical alignment occur simultaneously. After the usual taxiing turns, the plane takes off, changes heading, and climbs

jet had made a tight turn into its final pre-crash heading.

Recorders are required by FAA regulations on all aircraft flying above 25,000 feet. Had there been one aboard an Electra that crashed because of wing failure, the facts about that mysterious disaster might have been learned sooner.

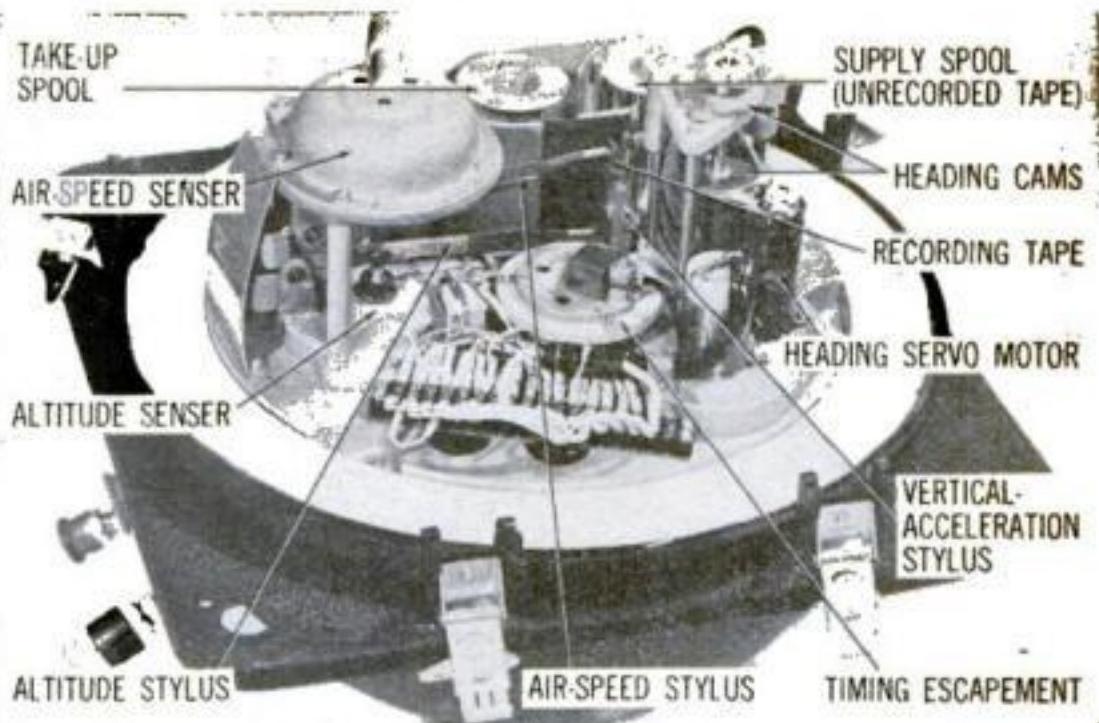
to 10,000 feet. At a speed of 300 knots, it swings onto a final heading of 300 degrees. Just 8½ minutes later, a short jump in altitude and vertical-G traces show that the pilot threw the nose up in an attempt to avoid a mid-air crash. Speed, altitude, and vertical-acceleration traces end in vertical rows of dots as the pilot's maneuver fails and the aircraft falls.

(Electras need not carry recorders because they are certified only for altitudes below 25,000 feet, although they can easily fly higher.)

Recorders aren't welcomed by all pilots and airlines. Like those in locomotives, buses, and trucks, they incur the enmity

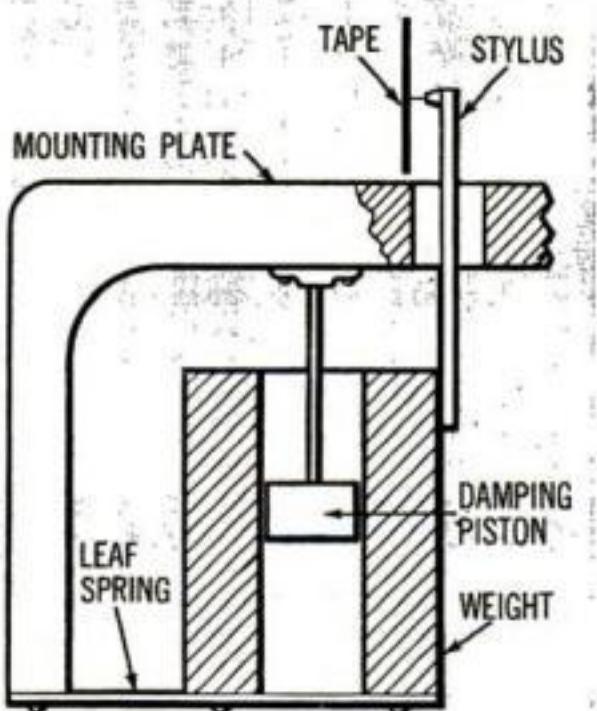
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Lockheed recorder embosses aluminum tape



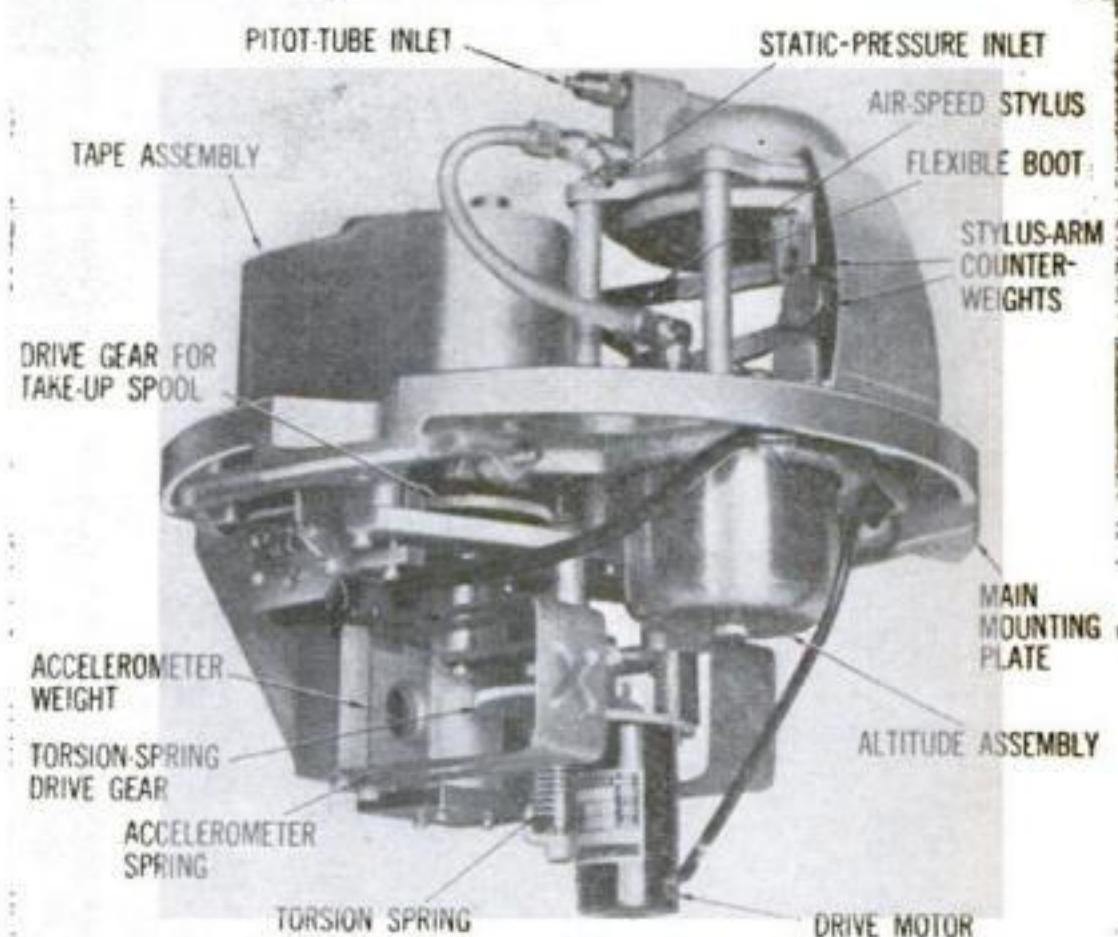
ENCASED IN STEEL—a double-walled sphere with insulation between—the Lockheed flight recorder has kept its tape intact under impacts of 500 Gs and heat reaching 2,000 degrees F. The top deck carries the tape and three of the sending devices that position the embossing

styluses. The couplings on the lower half of the shell case are for connection of the static, Pitot, and electrical lines. The tape for the Lockheed recorder is $2\frac{1}{4}$ inches wide and moves at a speed of eight inches per hour. One spool of tape records 125 hours of flight time.

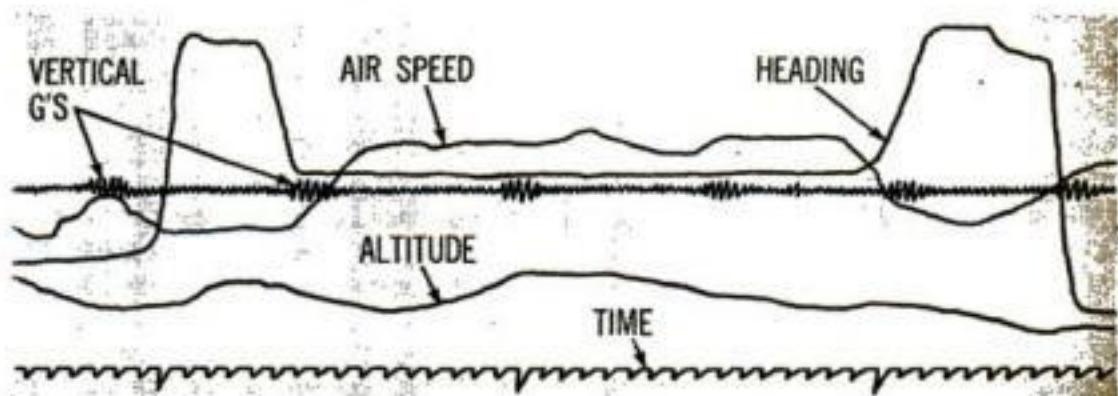


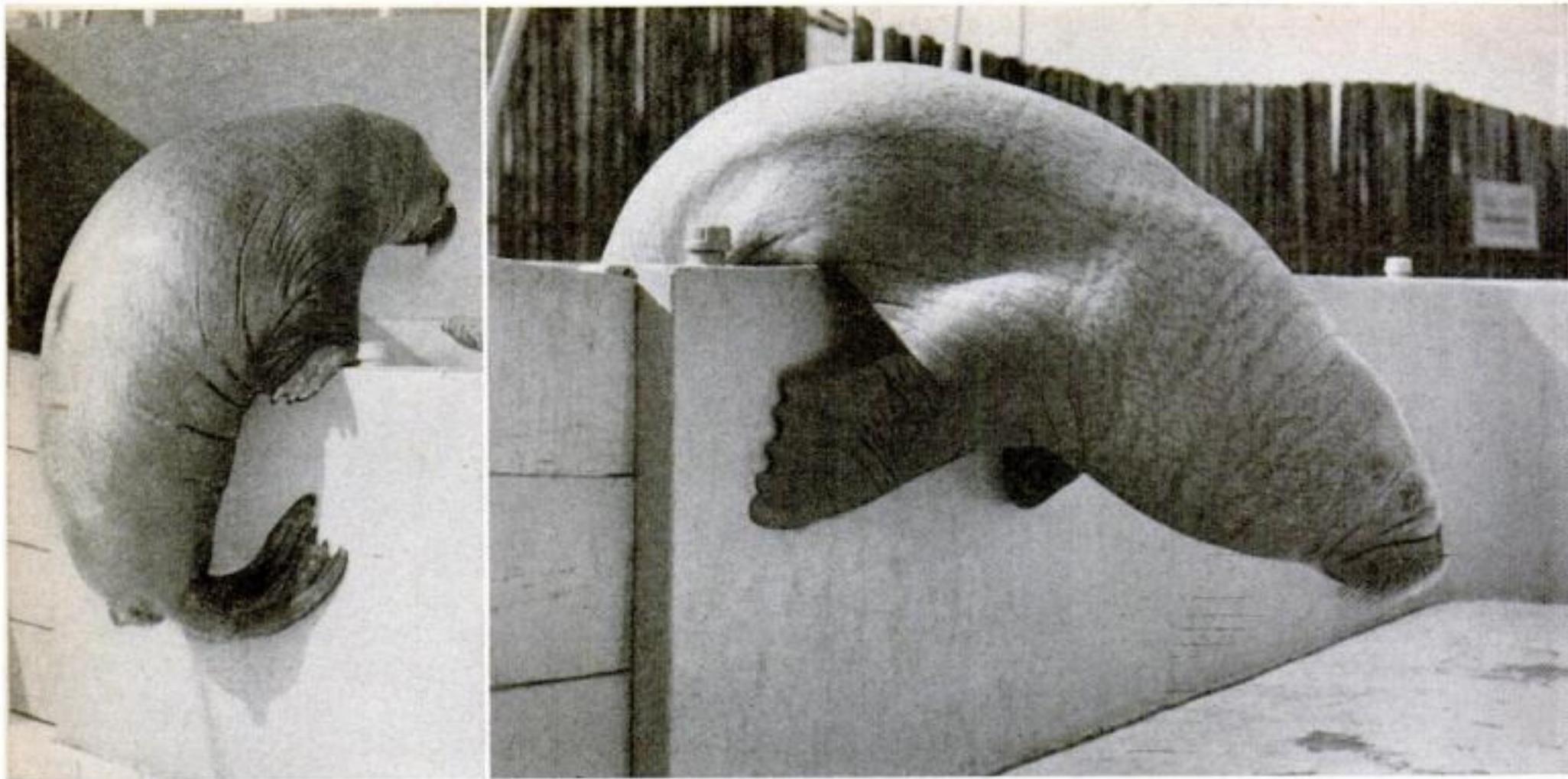
A WEIGHT SENSES the vertical G forces affecting the aircraft. Cylindrical weight is fastened to two spring leaves. As the airplane moves rapidly up or down, the weight's inertia makes it lag behind. A stylus fastened to it moves vertically against the tape. A piston in the cylinder maintains an air cushion that damps out small movements of the aircraft.

EMBOSSED TAPE from a Lockheed recorder has timing marks along an edge. As the styluses do not work side by side, but at different points along the tape, two events occurring at the same instant are recorded some inches apart. A transparent overlay laid on the tape aligns such simultaneous data with the timing marks.



TAPE-DRIVING MECHANISM is located under the deck. Torque applied to the take-up spool is regulated by a clock escapement. A notched disk on the escapement shaft triggers the timing stylus. The tape will continue to run at least 10 minutes after the plane's power fails.





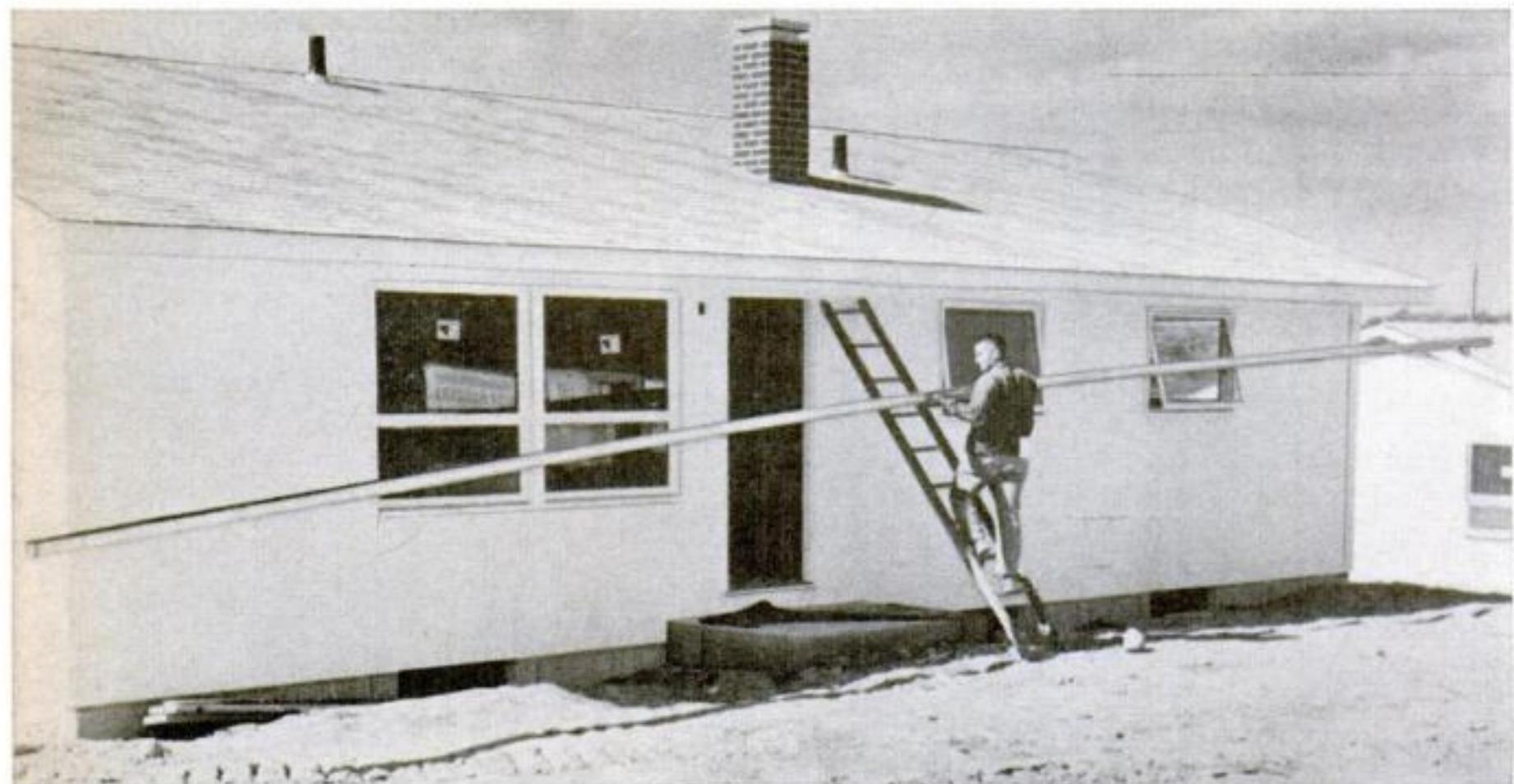
1. THIS IS OOKIE, a friendly Walrus. She's getting started on scaling a 3½-foot fence.

2. OVER OOKIE GOES, getting to the other side where there are many interesting people. There's a Carpenter in the story, too. He built the fence to keep Ookie away from the people.

The Walrus and the Carpenter

The adventures of that oddly matched pair, the Walrus and the Carpenter, were first noted in rhyme by Lewis Carroll nearly 100 years ago in his famous non-

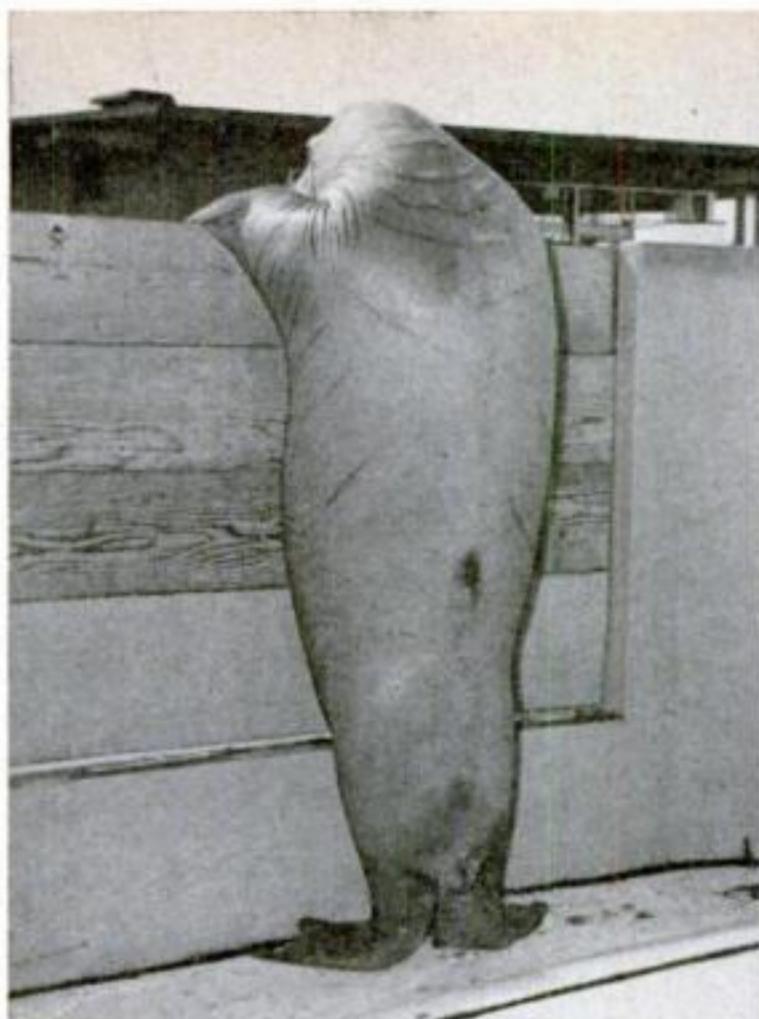
sense story, "Through the Looking-Glass." Now a new chapter has been written at the Coney Island Aquarium, a branch of the New York Zoological So-



House-length gutter

Gutters can now be obtained in one piece, with no soldering of joints required. Above is one of 500—full house

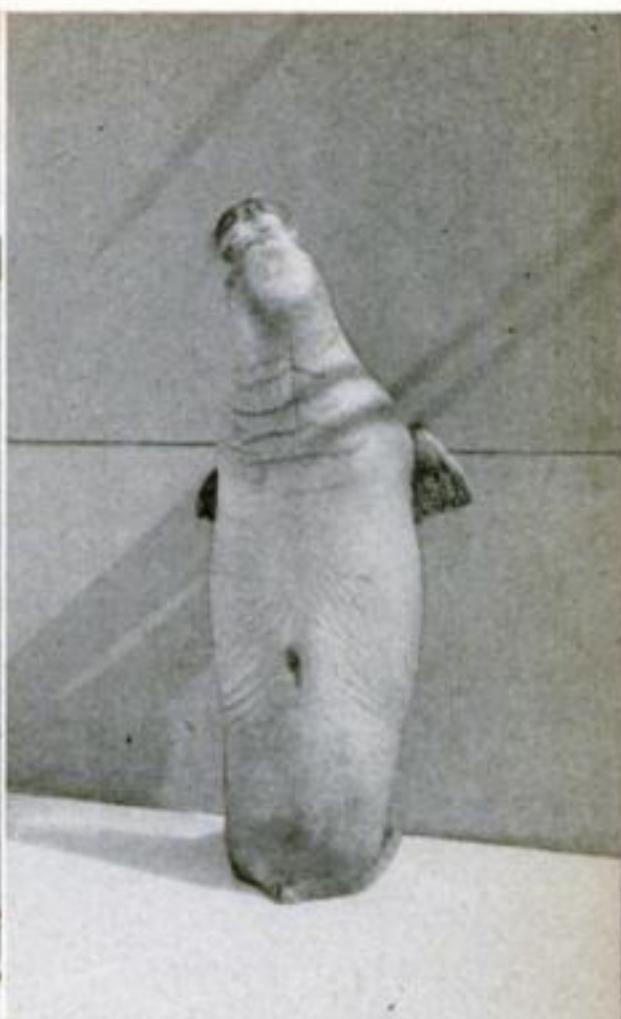
length of 45 feet, 5 inches—made to order by Republic Steel and delivered to a 250-home development in Cuyahoga Falls, Ohio. Shorter one-piece lengths of 23½ feet were prefabricated for garages.



3. SO HE BUILT A NEW FENCE, this one higher— $5\frac{1}{2}$ feet—in an attempt to thwart Ookie.



4. BUT A TOE HOLD on the first plank is all Ookie needs. So over the fence she goes again.



5. ENTER THE CARPENTER—to build a higher wall: $7\frac{1}{2}$ feet. Now Ookie really seems baffled.

society. The Walrus in our story had a habit of wandering out of her confines and mingling with—sometimes even frightening—visitors who didn't know her friendly and inquisitive traits. She was only in quest of fish, which somehow she felt hu-

man beings should carry in their pockets. So the Carpenter was called in to build a fence around her quarters: three, in fact, the last $7\frac{1}{2}$ -feet high and faced with plywood so she couldn't get a toe hold. This one has worked—so far.



Return of the rumble seat

The folding rumble seat in which mom and dad pitched woo back in the '20s may stage a comeback if Frank Hilker, a nostalgic auto dealer in Chicago Heights, Ill., has his way.

He designed and built this one, installed it in one of his stock cars. He hopes to sell Studebaker on it.



Air gun bats a baseball

A compressed-air machine is used by the New York Yankees for early-season training of catchers in the art of snaring high fouls. Here five of the team's catchers keep their eyes on the ball as the machine, triggered by Coach Jim Hegan, tosses it high into the air.



Hand gripping a fossil human leg bone, a skin diver rises toward surface at Little Salt.

Did Cavemen Live in Florida 80 Centuries Before Christ?

Maybe. It all started when an inquisitive skin diver found caves—with human bones—where they weren't supposed to be

**By Joan Steen
and
William M.
Stephens**

SKULLS, skeletons, and a miraculously preserved section of human brain that may be 10,000 years old are the startling new clues to man's past—not in Egypt or India—but in America.

The bones and tissue, recovered from the mud bottoms of salt-water springs near Sarasota, Fla., probably belong to members of a vanished tribe. The land they roamed then was dry and crisscrossed by limestone caves. But with time and a rising sea level, the caves were submerged. Today some lie as



William Royal holds basket of bones brought up from 50 feet below.

much as 80 feet under water. Their rediscovery, like many archaeological triumphs, came by chance.

Inquisitive diver. William Royal, a 55-year-old ex-Air Force colonel from Venice, Fla., began skin diving a few years ago. Late in 1958 he made his first deep dive in Warm Mineral Springs, a health spa between Venice and Punta Gorda—about halfway down the west coast of Florida.

At depths of 25 to 80 feet Royal found stalactites hanging from ledges. Unusual, he thought. Stalactites have no business being under water. They're formed when mineral-laden water seeps through a cave roof and evaporates, leaving deposits of lime. Stalactites need air to grow.

Dr. H. K. Brooks, a University of Florida geologist, heard of Royal's odd cave and came to investigate. The formations were true stalactites, he agreed. It could mean only one thing: The spring had once been dry, perhaps during the last Ice Age.

In the meantime, Royal decided to try his luck at another deep watering place, Little Salt Spring, a mile and a half away. In January, 1959, he hiked across the palmetto thickets, made his dive, and found more stalactites. But this time something else: a human leg bone. Royal decided it was time to call in experts. On his second trip he brought a crew



Bone and rock tools were found buried in mud. At right are bone needles.

CONTINUED

Diver examines bone fragments found in the sediment at Warm Mineral Springs, Fla. Besides human bones, divers found a range of animal bones that included raccoons, alligators, rodents, birds, and deer. In addition, pine cones, hickory nuts, acorns, wood, and charcoal have turned up.



Skin diver Royal uses his mouthpiece to inflate a plastic bag to lift a basket of bones to the surface. He is standing on a ledge 50 feet under water at Warm Mineral Springs.

with him that included biologist Dr. Eugenie Clark, director of the Cape Haze Marine Laboratory at Placida, Fla., and anthropologist Dr. Luanna Pettay. Both are competent skin divers.

Here's how Bill Stephens, another diver who was along (and a co-author of this article), pictured the scene:

"The setting was quiet and unspoiled—almost primeval. Moss-hung cypresses surrounded the placid pool, 100 yards in diameter. Along the shore the gnarled heads of alligators broke the surface without sound—their cold eyes watching us suspiciously. In the center of the pool rolled several tarpon."

Alligators, tarpon, and divers got used to each other in the next couple of weeks, for the party made many expeditions to the spring, each time finding more caves and more bones. Seventy feet down and 40 feet back inside one winding cavern, Royal found a complete human skeleton pinned beneath a boulder. Like most of the bones found, it was left undisturbed so that archaeologists could examine it in place. Relatively few bones—representing about 50 people in all—were brought up for study.

By this time it was clear that the spring was no watery graveyard for some recent Indian community, nor was it the site of a bloody massacre. What Royal had stumbled upon were the cave dwellings of some of the earliest settlers of the "Southeastern Archaic" era—stretching back 10,000 years.

But critical proof of age was needed. It turned up at Warm Mineral Springs. In April, 1959, the party shifted its operations there. Heavy rains had washed out access to Little Salt Spring, even with the party's doughty little swamp buggies—geared-down Model As with balloon tires.

Almost immediately Royal began finding human bones. Most of these were deep under ledges covered by a foot or more of sediment—encouraging evidence that they had not fallen from the surface in more recent times. These bones were smaller and darker than those uncovered at Little Salt Spring. Some were already fossils—the original organic matter had been replaced by minerals.

Primitive campsite. Then, in a cave under several feet of silt, Royal found a partially burned log wedged under a



large rock. A human jaw bone was pinned underneath, and a finger bone lay beside it. This was exciting news. Importantly, the sedimentary layers above the charred log were undisturbed. Besides, how could it have jammed itself under a rock? Surely it must have been burned on the spot. In all likelihood they had found the primitive campfire of archaic Florida cavemen. What's more, since the log was organic matter, it could be dated by Nobel Prize winner Willard Libby's carbon 14 technique that measures the amount of the radioactive isotope still present in once-living matter. (The bones are harder to date. In their partially fossilized state they lack sufficient organic material.)

A sample of the log was sent to the Scripps Institution of Oceanography at La Jolla, Calif. There, Dr. Carl L. Hubbs considered the log's potential so important that he ran the test himself. In October, 1959, the results were released. The sample was 10,000 years old, give or take 200 years. This is the oldest radiocarbon date ever obtained for the Southeastern United States—a major scientific discovery, according to Dr. Hubbs. (Prior to this, the earliest dating of man in Florida was about 6,500 years ago.)

Mud packs. The cave where the log was found lay 35 to 40 feet under water. A diver slowly making his way through the green water soon entered a black world of three distinct layers of sediment, in some places seven feet thick.

The log was 38 feet down in Layer 3—the bottommost shelf of sandy hard-packed silt (further evidence that the log had not drifted there by accident). In this same layer the skin-diving scientists found bones of turtles, birds, raccoons, deer, and men.

Most exciting find is this human skull with brain tissue still intact. Antibiotics in the water may have preserved it.



Royal and Dr. Eugenie Clark sort bones and dip them in preservative. The piece of skull held by Dr. Clark may be more than 10,000 years old.

[Continued on page 194]

How We Can Beat Russia's Big Rockets in 18 Months

FOR many months, top Washington officials have been debating whether Russia leads us in missile power—and by how much. To the public this is a curiously misleading debate. For while there may be some question about how many missiles the Russians have actually stockpiled, no one doubts for a moment that they are far ahead of us in rocket boost. Our largest flyable motor, the power plant of the Atlas, produces about 300,000 pounds of thrust. We know the Russians are already using rockets up to three times more powerful.

That's why they can orbit Venus before we shoot the moon. Even assuming that everything we're now building turns out for the best, it will take us years to fly an American equivalent to their present space vehicles. And since we have no reason to suppose that Soviet scientists are all asleep on their launching pads, their progress in these next years will still leave us dangerously behind. Thus our present long-range planning dedicates us to perpetual second place.

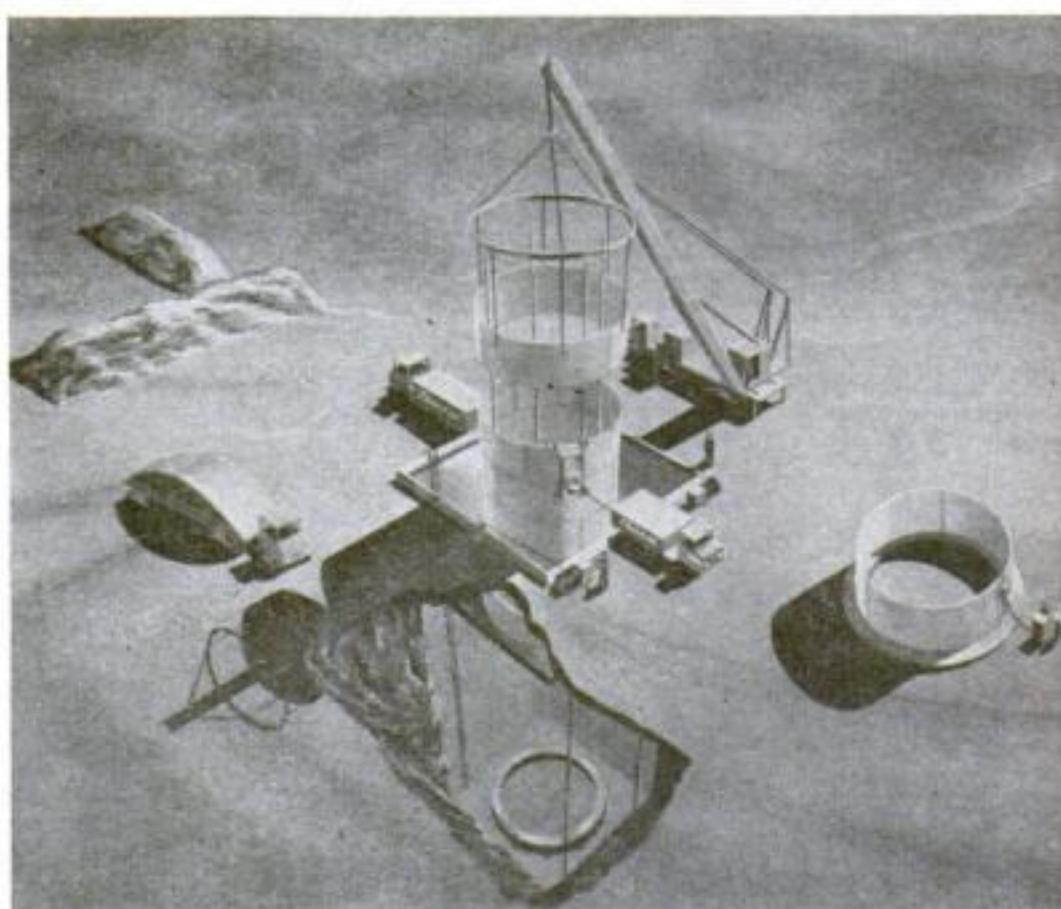
Yet with a slightly different program we could zoom ahead by millions of pounds of thrust. We could do it in three years; a crash program would put us in the lead in 24 months—or possibly as little as 18—and we can use existing solid rockets to match their capabilities.

Most of our big rocket boosters—and probably all of Russia's—get their thrust from liquid-fueled engines. In this department they are far ahead of us. Though we are constantly getting more thrust out of our liquid fuels, surpassing the Russians will require technical breakthroughs that cannot now be foreseen.

But it isn't necessary to wait for them.

We already have a tremendous head start in the development of solid rocket fuels. These are the propellants that have been used with outstanding success in the Minuteman, Nike Zeus, and other missiles. We already know how to combine solids for any blast-off power that might reasonably be needed. We can, in fact, meet what appears today to be "unreasonable" requirements of two, five, ten, or fifty million pounds of thrust. And we can control the chemistry to yield almost any desired flight characteristics. Problems remain to be solved. But these are in the realm of engineering and construction—not basic research.

One way to build bigger rockets



FIRST STEP in on-site rocket construction is to dig a casting pit deep enough for the first-stage booster. Here circular sections of the case are shown being lowered onto positioning rods; they are then welded into a unit.

The author of this article, Dr. Harold W. Ritchey, is one of America's best-known pioneers in rocket research. Dr. Ritchey is currently president of the American Rocket Society, and Director of Rocket Operations of the Thiokol Chemical Corporation, which makes liquid-fueled engines (for the X-15 manned space plane) and solid-fueled engines for the Minuteman, Nike Zeus, Pershing, Mace, and other missiles. The opinions expressed in this article are Dr. Ritchey's; they do not necessarily represent the views of the American Rocket Society or of its other members.



Solid vs. liquid. To see why we could readily leapfrog the Soviets into space, you must understand some differences between solid- and liquid-fueled rockets.

Liquid-fueled rockets need tanks for storing the propellant fluid, plus pipes, valves, and pumps for delivering it to the combustion chamber.

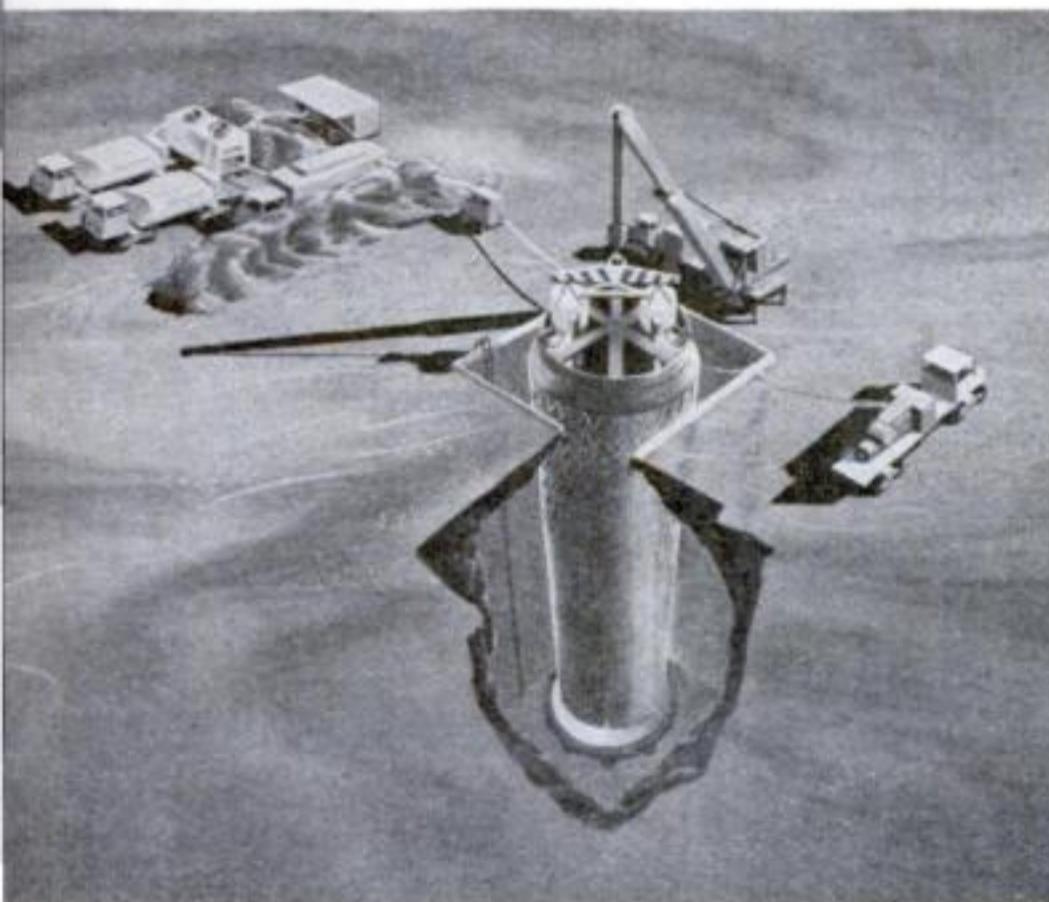
A three-man spaceship would have to carry more turbopump horsepower than is developed by all the pumps of the Grand Coulee Dam. This obviously adds up to an enormous amount of machinery that has to be made flyable.

By contrast, a solid-fueled engine simply avoids all this dead weight. It is a

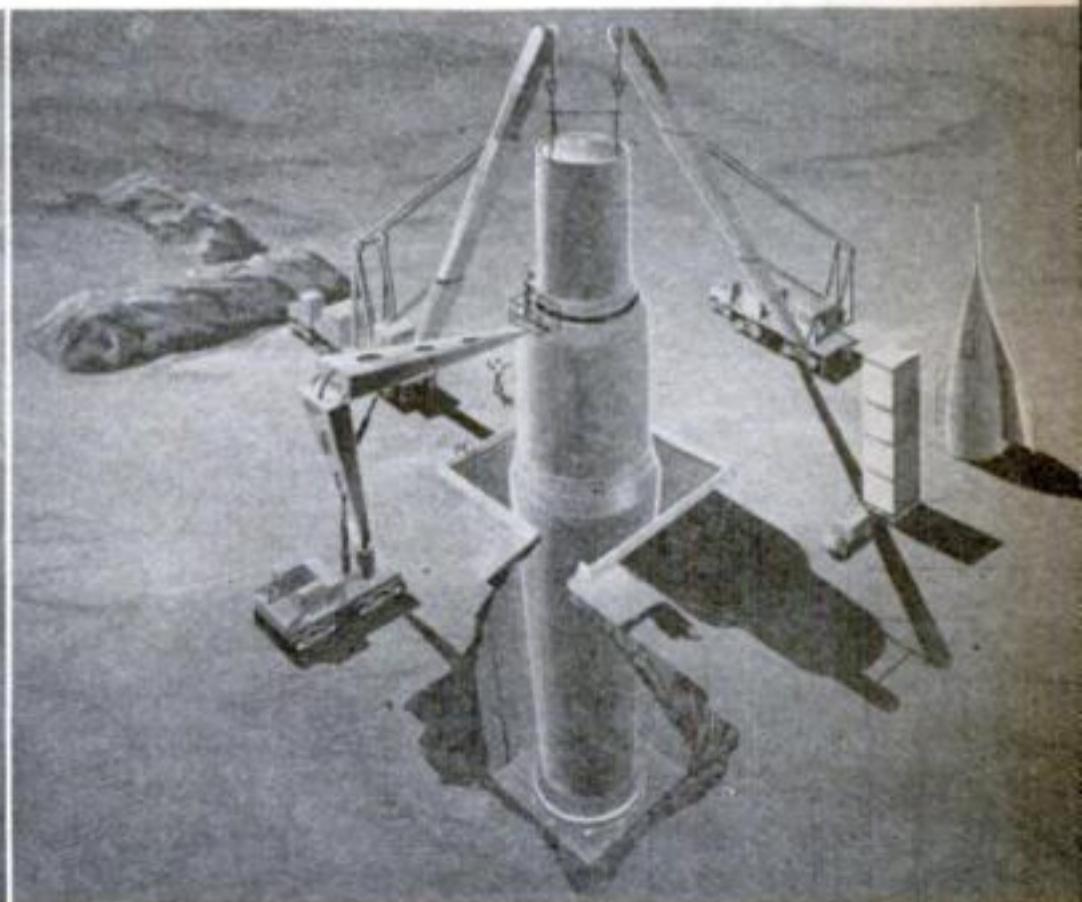
case wrapped around a fuel charge. The entire assembly becomes a combustion chamber. Solids can deliver far more thrust per pound of rocket because the pumping problem is avoided.

There is another important difference. Solid-fueled rockets can be scaled up almost without limit, while the enlargement of liquid engines is hampered by many practical obstacles. For instance: The world's largest machine tools are barely able to produce components that would be needed for a liquid-fueled engine of, say, two million pounds thrust. Technically, it is much easier to develop 20 million pounds of solid-fuel thrust.

faster is by assembling and loading them on their launching pads



FLUID SLURRY of solid fuel can now be loaded into the shell. Both the casting pit and the case are "environmentally conditioned" by electric heating elements that "cure" and solidify propellant, keep it at constant temperature.



UPPER STAGES could be similarly constructed at the launching site, or they could be built nearby, then joined, as shown, to the space vehicle's booster. One or more upper stages might be powered by liquid or nuclear fuels.

CONTINUED

69

I don't mean to suggest that liquids are obsolete by any means, or that they won't play a key role in space exploration. The burning rate of a solid fuel, a vital factor in a rocket's performance, is a built-in part of its chemistry. Liquids, on the other hand, can be made to respond to throttle control by radio signals or human pilots. This makes them much more practical in jobs that require speed variation or midflight starting and stopping.

Liquid fuels, in other words, are ideal for the upper stages of spaceships. But to lift these stages we need solids on the bottom. This is exactly the reverse of our present vehicles.

A mere switch to solids won't, of course, solve all our problems automatically. To put us well ahead of the Russians we might need a space vehicle with a weight of five million pounds. Getting this off the ground could best be done by something over 10 million pounds of thrust—about 10 times what the Russians now have, or than we are likely to have in the next three years if we don't start new development work on solid boosters.

There is no great difficulty, as I have said, about building an engine for the first stage of a space vehicle of this size. But since it would weigh a bit over $3\frac{1}{2}$ million pounds, it would be too big and heavy to be transported by any conventional means.

How, then, would we get it to its launching site?

The problem boils down to this: We must either eliminate all transportation and handling of a complete rocket engine (or of any major subassembly), or we must find ways of moving the enormous weights involved.

Unconventional transport might help. For example, an assembly plant might be built at the edge of a waterway so the booster could be floated to its pad. Or we could follow the example of a shipbuilder who often builds his structures

in a dry basin, then floods the basin so the ship can be floated away.

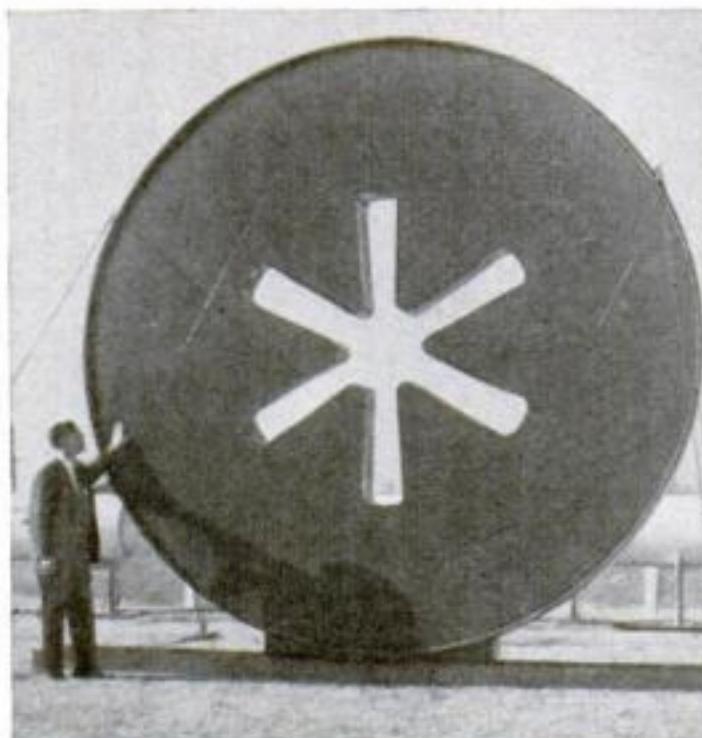
And there's another solution that will be glaringly obvious to any construction engineer—or even to a sidewalk superintendent who has ever watched a major structure going up. No road builder would think of casting concrete paving slabs at a factory and then hauling them to the job. Instead, he moves his mixing machines to the site and casts his concrete in the place where it will be used.

In exactly the same way, solid rocket fuels could be mixed and loaded at the launching site or floated to the launching site by the dry-basin method. If necessary, the case and other hardware could be built nearby and floated down; river transport would be ideal for this since the empty case would present a problem only of size.

Needed: new techniques. Up to now, rocket engines have been built in the time-honored traditions of artillery shells and aircraft motors. To take a

giant step in space exploration we need different techniques borrowed from shipbuilding and construction. Applying them to rocketry is a matter of political decision—but not of technology. Nor should this space leap raise any problems of cost: Solid fuel provides the cheapest, as well as the most practical, power for starting man into orbit. Its economy has already been well demonstrated by, say, the Minuteman ICBM. Many independent studies show that solid-fueled boosters can be built for well under two dollars per pound of rocket.

But however important, economy is only a pleasant by-product of our most advanced rocket engines. A majority of Americans would undoubtedly agree that we can't afford to settle for second place. Pilot programs have already demonstrated that leadership is within our grasp. Once we decide to take it, we can leapfrog the Russians by a wide margin within two or three years.

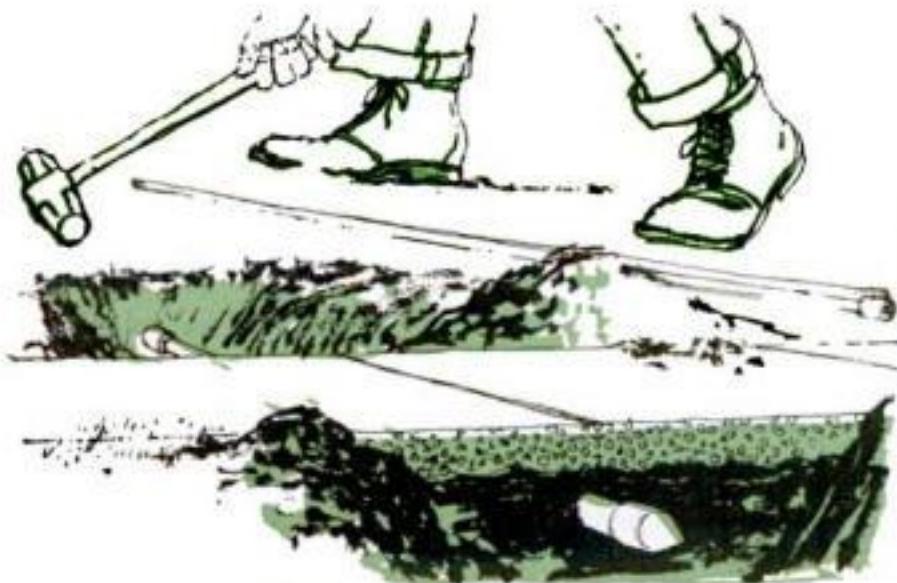


SOLID-PROPELLANT MOTOR, under study by Thiokol Chemical Corp. for National Aeronautics and Space Administration, would be 14 feet in diameter, with 2,400,000 lb. thrust.

"I'd like to see them make..."



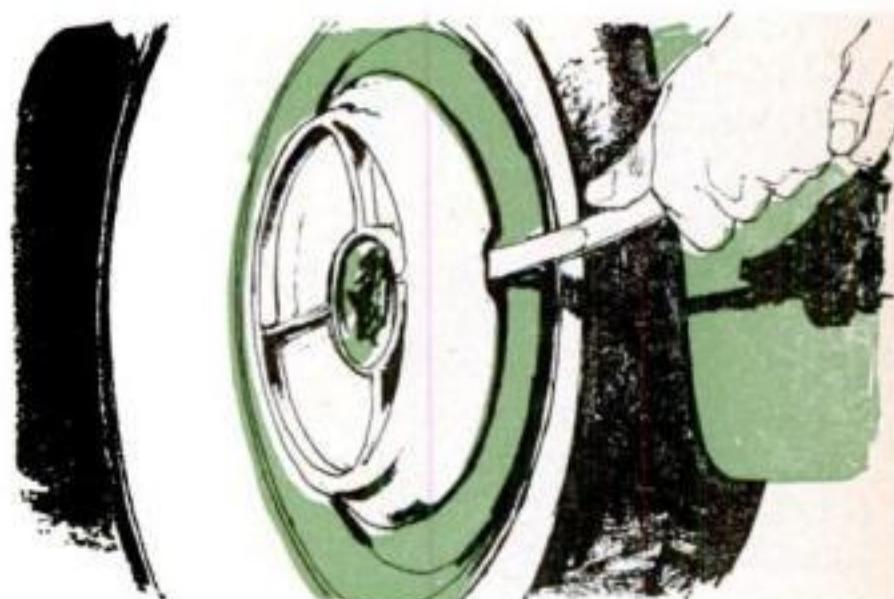
LUNCH-COUNTER STOOLS that could be slid in floor slots to adjust distance from the counter. Then both fat men and thin men could eat in comfort.—*Patrick Hall, Fort Smith, Ark.*



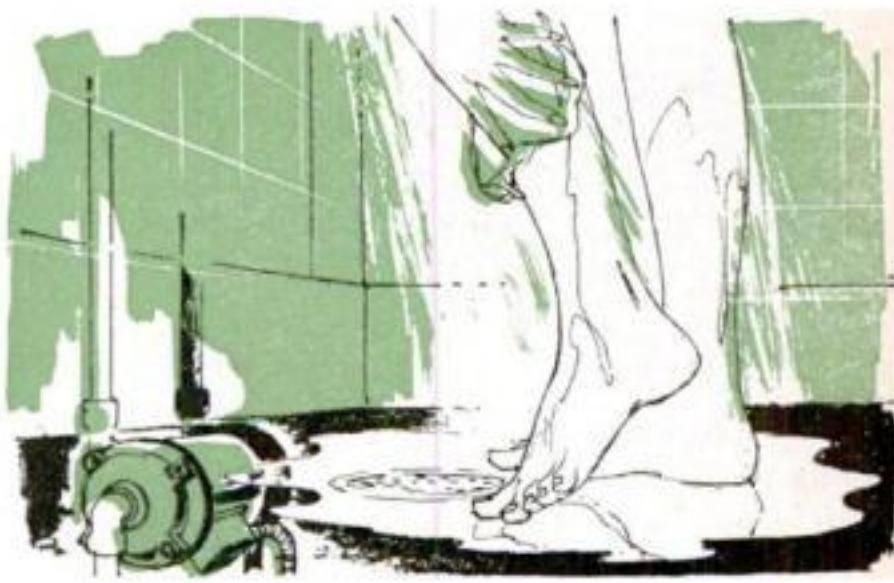
PIPE CAPS, in both pointed- and flat-end designs. Hammering a flat one would drive pipe under a sidewalk to carry cable for outdoor wiring.—*Steve Hullcranz, Oak Park, Ill.*



UNDERWATER WEED CUTTERS you'd attach to an outboard motor with its prop removed. They'd work like a rotary lawn mower while you rowed the boat.—*A. Malinick, Thornwood, N.Y.*



INDENT NOTCHES at either side of automobile hubcaps. The pesky job of prying off the caps with a tire tool would sure be a lot easier.—*Edward Podalske, Crystal Lake, Ill.*



SMALL WATER PUMPS for pipes leading to a shower or a garden-hose faucet to keep pressure constant if water is drawn elsewhere in the house.—*Kurt Alverson, Tonawanda, N.Y.*

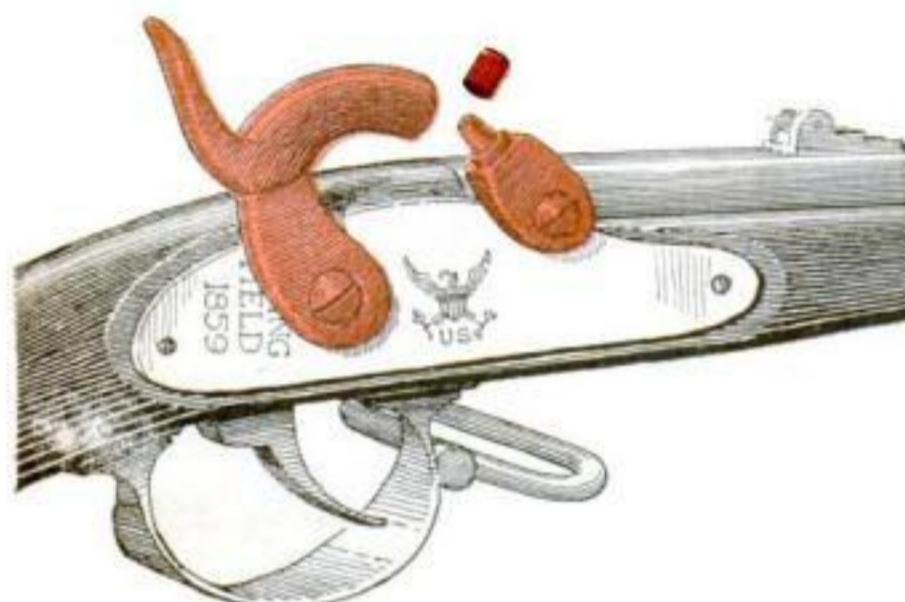
Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE readers. What's

yours? We will pay \$5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

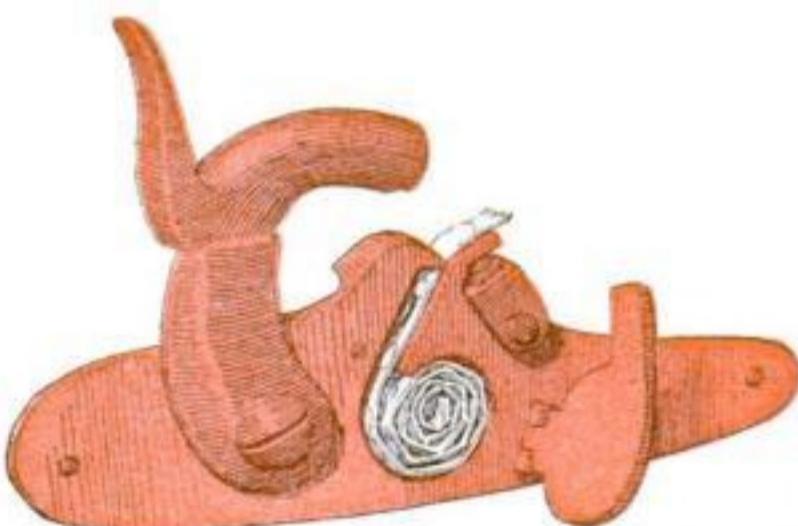
Shoulder Arms: 1. Musket



**Springfield Model 1861
Rifled Musket**



PERCUSSION CAP was a small copper shell with a dab of fulminate of mercury in its base. The gunner fitted it on a steel cone, drilled to connect with the gun's chamber. The hammer exploded the fulminate and fire flashed through the hole to ignite the powder charge.



SIMPLER PERCUSSION METHOD was originated by Dr. Edward Maynard, a dentist. He put dabs of fulminate into a roll of paper tape. Many guns used his primer, but by no means all.



PAPER CARTRIDGE, introduced by Gustavus Adolphus of Sweden in the 17th century, was still in use in the Civil War. It provided a premeasured powder charge and a ball in one package. The soldier bit an end off to get at the contents. Slacker draftees sometimes had their front teeth pulled to avoid Army service.



**First in a series of exclusive articles on the weapons that
won—and lost—the War Between the States a century ago**

to Breechloader

Text and drawings by Edwin Tunis Author of Weapons: A Pictorial History

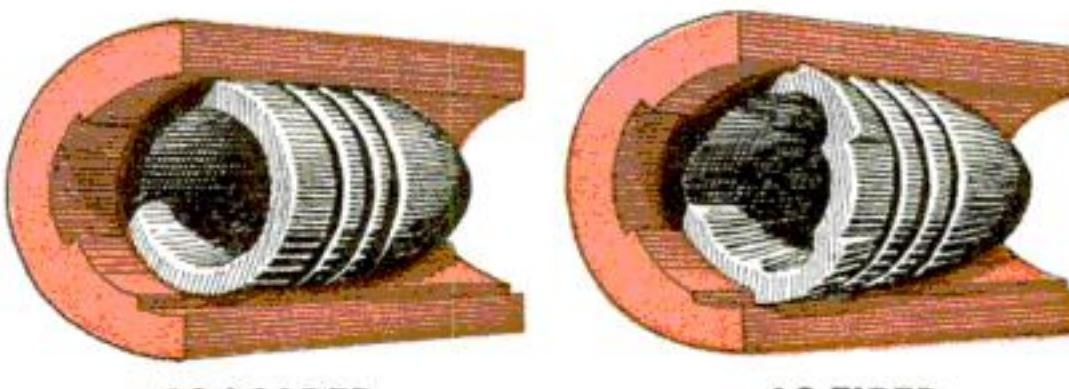
WHEN Fort Sumter fell, April 12-14, 1861, the Union Army had some 250,000 smoothbore muzzleloading muskets. The Army had experimented with breechloaders and abandoned them. It had, however, recently adopted the Springfield rifled musket and had about 10,000 in stock. But it, too, was a cap-fired muzzleloader.

Its ramrod fitted into a tube under the barrel. Cartridges rode in a leather box, double-lidded so that access was difficult, and slung at the soldier's right side. Caps were in a pouch on his belt. When a soldier stood up to bite open a paper cartridge and pour its powder into his gun barrel, to shove a ball down after it with the ramrod, and then to fumble in his pouch for a cap to fire the charge, he almost asked to be shot. A cool and efficient man could fire three times a minute at best. But if whistling bullets excited him at all, he might forget he had

loaded and ram more charges in on top of the first. One way or another this put man and gun out of action. Eighteen thousand muzzleloaders abandoned at Gettysburg held more than one load.

Test-fired by Lincoln. General James W. Ripley, the Army Chief of Ordnance, thought cheap muskets the right guns for civilian soldiers; he was wrong, if only because a breechloader couldn't be double-loaded. The Sharps breechloading rifle had proved itself in civilian life, but Ripley called it a newfangled gimcrack. Abraham Lincoln tested the Sharps himself, as he did many guns, by firing it into a woodpile on a back lot. He found it good and overruled the general. But Ripley still would buy no more than he was directly ordered to, so only a few thousand Sharps actually reached the field, and of those many were bought by the states for the militia.

Various experimental repeaters had ap-

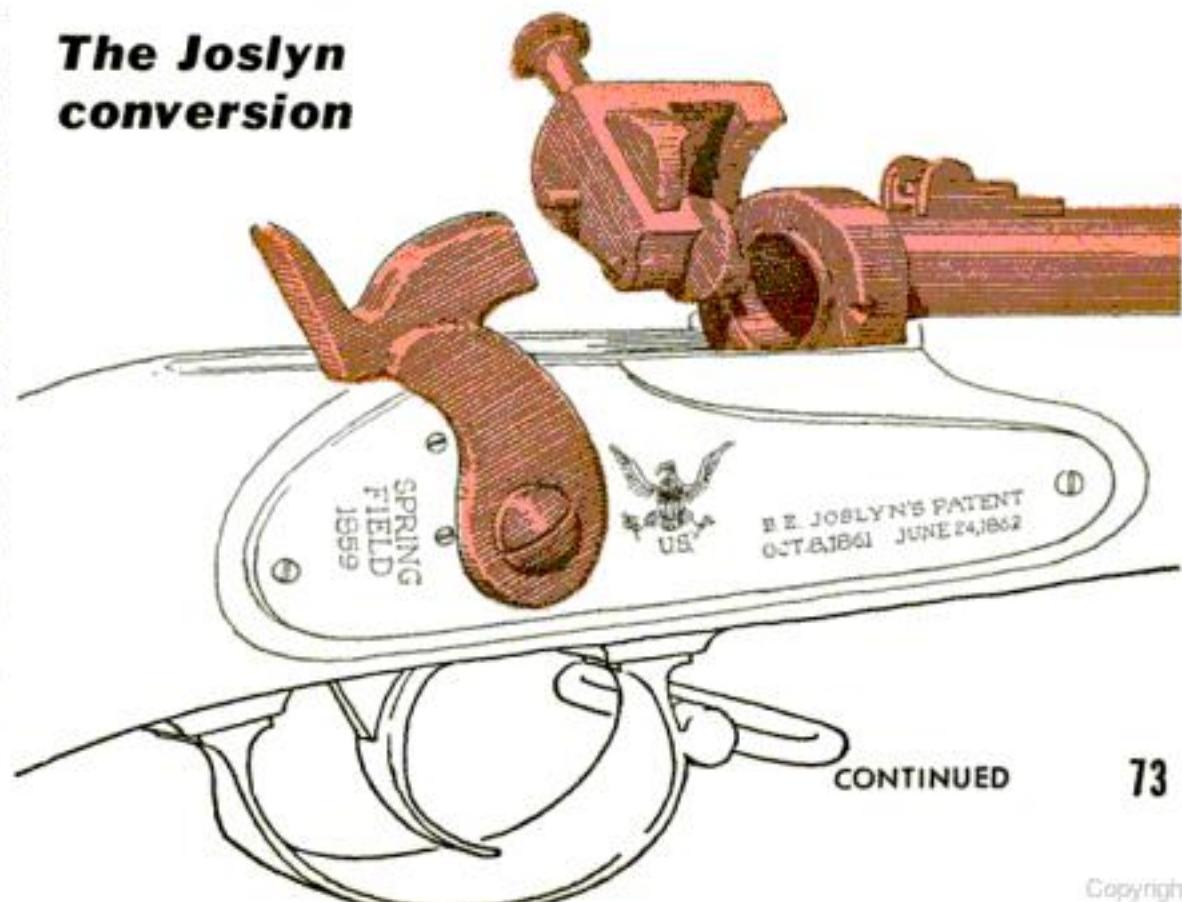


AS LOADED

AS FIRED

THE CONVERSIONS: When the advantages of breechloading became apparent, Samuel W. Marsh sawed a chunk off the back end of a Springfield barrel and replaced it with a hinged breechblock. Lincoln tried it, and in October, 1861, risked giving General Ripley apoplexy by instructing him to order 25,000 of the conversions. This was the war's biggest contract for breechloaders, but few were delivered because Marsh had troubles, and every time a consignment was late, Ripley canceled it. Other conversions were tried. The Joslyn (right) breechblock swung perpendicular to the bore and a cone arrangement sealed the breech.

The Joslyn conversion



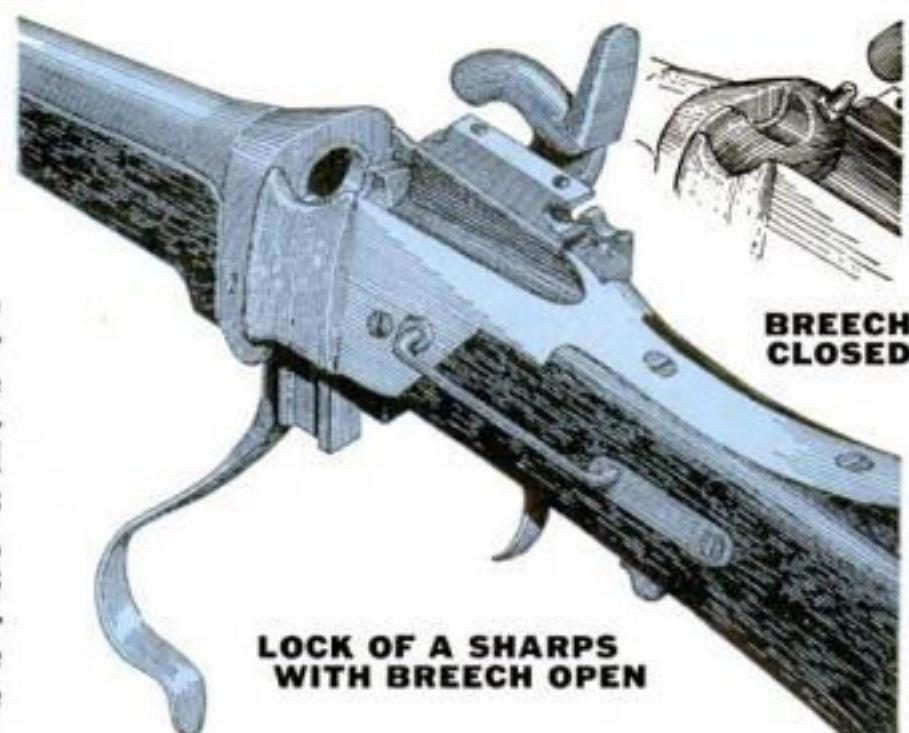
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2. Breechloader to Repeater

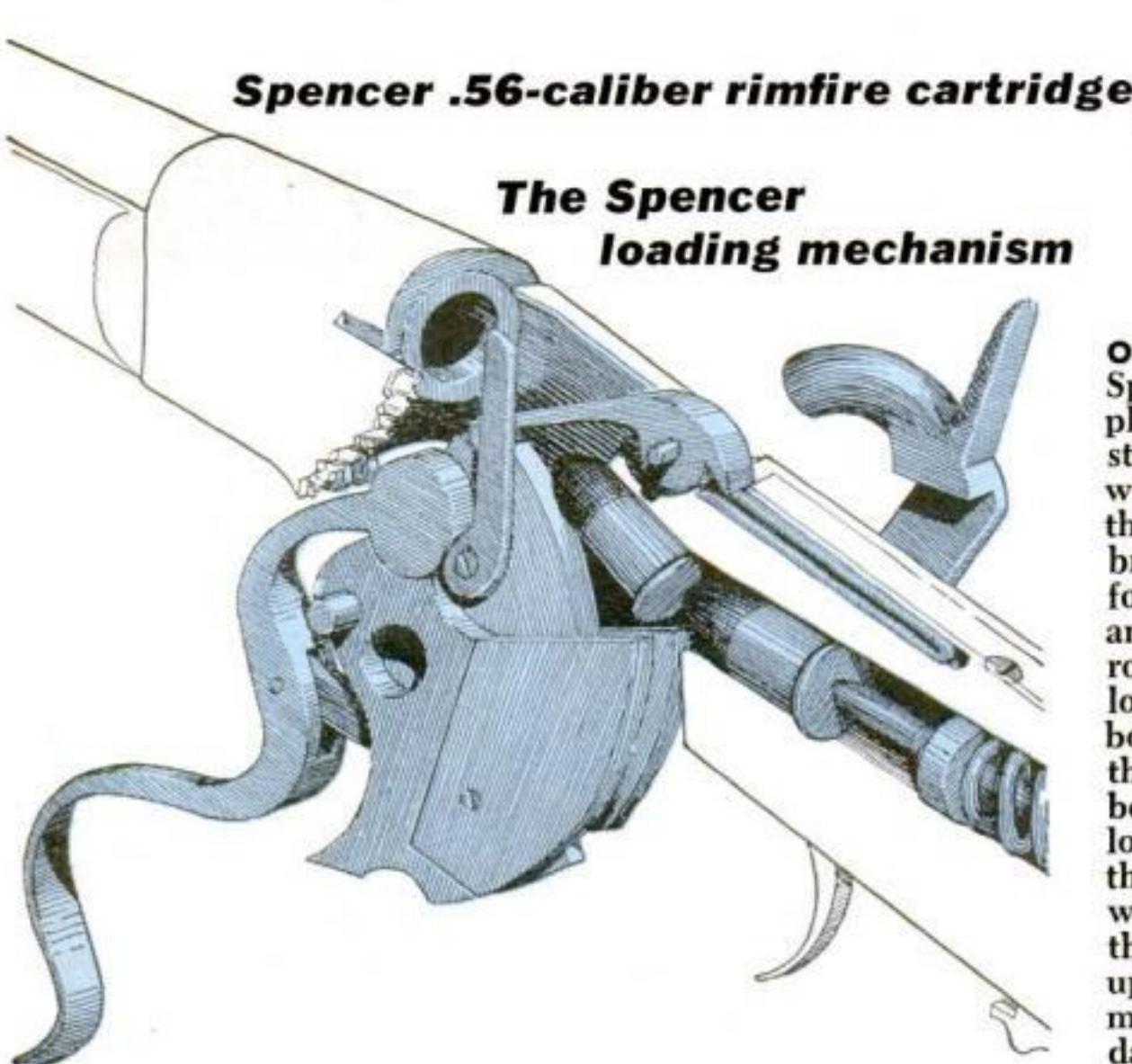


**The Sharps
Percussion Carbine,
Model 1859**

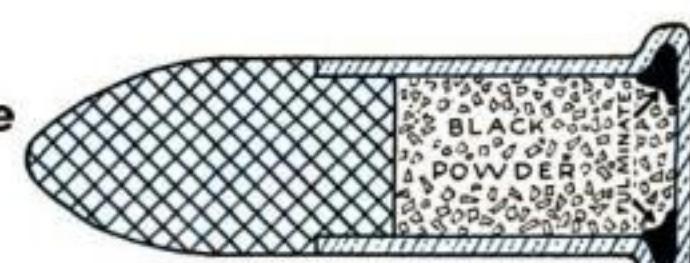
SHARPS .54-CALIBER SINGLE-SHOT RIFLE was the earliest successful breechloader. A hinged trigger guard lowered the breechblock for loading and the block sliced the end from a paper cartridge as it returned. From 1862 on, many Sharps were altered to take brass cartridges. A man could fire a Sharps 8 or 10 times a minute, remaining prone, in cover, to load. Colonel Hiram Berdan's Sharpshooters first demonstrated this advantage at Mechanicsville, Va., in June 1862. Had any considerable number of Union troops been armed with these rifles, the war might have ended at Gettysburg.



**LOCK OF A SHARPS
WITH BREECH OPEN**



**The Spencer
loading mechanism**



OPERATOR FED SEVEN ROUNDS into a Spencer through a trap in the butt plate to a tubular magazine in the stock. A coil spring pressed them forward and a rolling block, moved by the trigger guard, fed them into the breech one at a time. As it rolled back for the next shell, the block withdrew and ejected the casing of the fired round. The seven-shot tubes could be loaded in one quick motion. Ten-tube boxes appeared in the latter half of the war, but the feed spring still had to be removed and replaced for each loading. Still, military men estimated that a soldier with a Spencer in cover was worth eight men with muskets in the open. Possession of a Spencer built up a man's morale, even though he might be repeatedly ordered to the dangerous forward skirmish line.

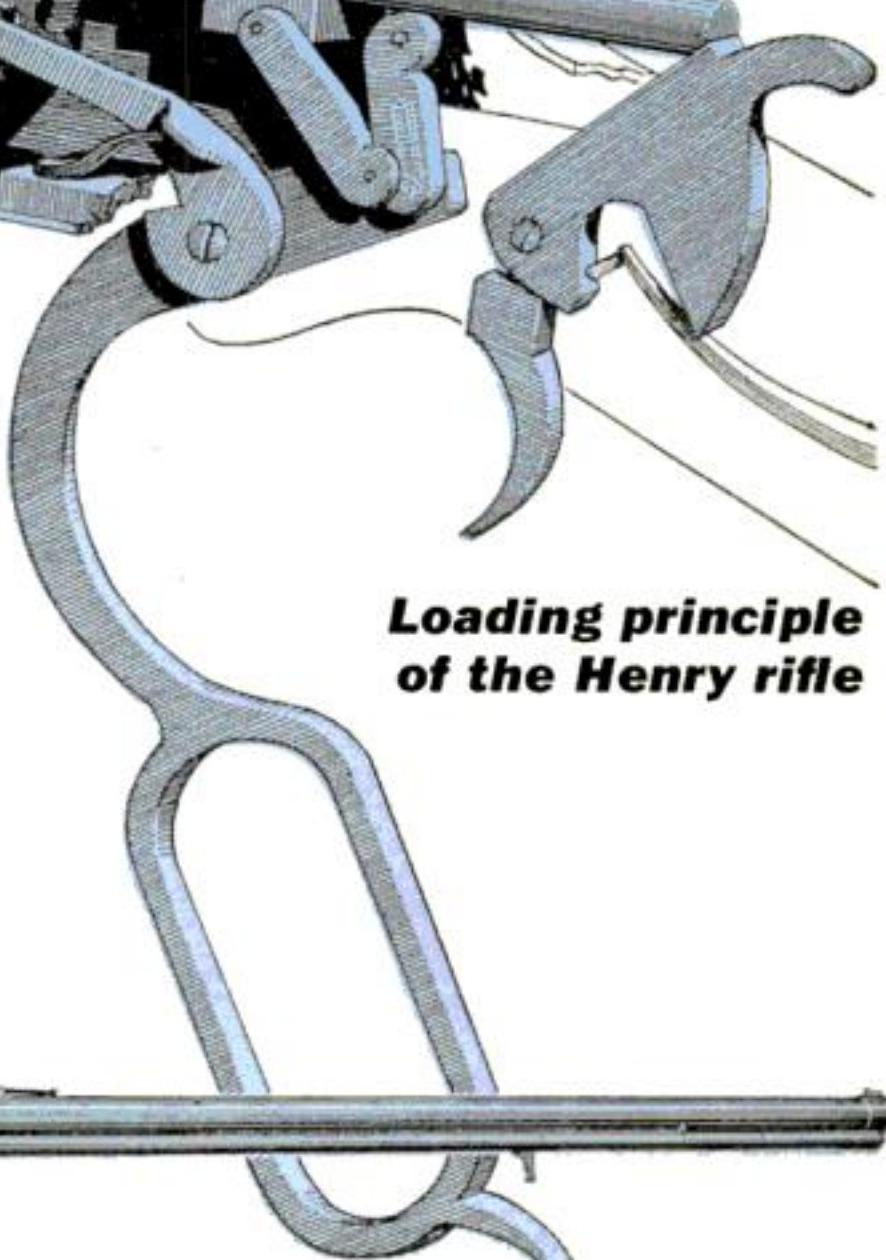


**Regulation Spencer Repeating Rifle,
Model 1860**

Henry .44-caliber rimfire cartridge



THE HENRY'S TUBULAR MAGAZINE lay directly under the barrel. Pressing forward a lug that rode a slot in the underside of the tube compressed a feed spring and allowed the end of the magazine to open. Fifteen cartridges could be dropped in and the released spring urged them toward the butt. The rearmost shell rested on a carrier block within the gun lock. Swinging the trigger guard forward opened the breech and ejected a fired casing; at the same time it cocked the gun and raised the carrier to the level of the chamber. Returning the guard straightened out a toggle linkage to make a rather complex breechblock-and-piston shove the cartridge off the carrier into the chamber and seal the breech. At the end of the back swing, the carrier reached bottom again to get the next round. The hammer hit the piston, which transmitted the blow to the firing pin.



**Loading principle
of the Henry rifle**



The Henry Repeating Rifle

peared in the 1850s, some with rotating turrets, some with parallel chambers like harmonicas. Samuel Colt's rifle had a cylindrical block of chambers like the one on his Patent Revolver; it wasn't so good on a rifle. All these guns blew back hot gas, backfired, or, worse, chain-fired all their charges at once. A good repeater had to wait for a practical metal cartridge, containing its own primer, and the first good one was the Spencer.

The President fired a Spencer and liked it even better than the Sharps Army and Navy experts agreed with him. They buried the Spencer in sand and soaked it in salt water and it still fired its 20 shots a minute. Once more, only Lincoln's executive order made Ripley buy 10,000 Spencers, in December, 1861. Altogether the Government bought 94,000, mostly cavalry carbines.

"That damyankee gun." The Henry, which became the Winchester, wasn't

offered until mid-1862. Hence the Government bought only about 1,700 pieces, but purchases by the states brought the total in action to about 10,000. The Henry's 15 shots earned it the famous Confederate description: "That damyankee gun that can be loaded on Sunday and fired all week." It had weaknesses as a military arm: A dented magazine tube could cripple it, and its firing pin sometimes broke at bad moments.

On the Southern side, the foot soldiers fought mostly with hand-me-down weapons. The Confederate States seized five small arsenals in 1861 and impounded about 135,000 small arms. When they shortly captured the Harpers Ferry Arsenal, they moved its machinery south and copied Yankee guns. The Rebs bought arms in Europe and ran some through the Union blockade, and they captured guns in various engagements. But they never had enough.



How you put them on

1. **HANDCUFFS OPEN** automatically when you strike the wrist with the lower section, which swings out on a pivot.



2. **THIS PRESSES** the toothed lower section up through the two parallel bars that form the top part of the cuff and act as a slot.

Handcuffs that defy escape artists

Put ordinary handcuffs on an experienced criminal and he can get out of them with a pry, a screwdriver, a beer-can opener, or a hairpin. Put these new cuffs on a prisoner, double-lock them by pressing a cylinder lock in the hinge, and he can be freed only at the police station where the desk sergeant has the key.

The arresting officer doesn't need a key. He puts the manacles on by slapping a pivoted bar on the prisoner's wrist; it swings around and locks shut on a ratchet.

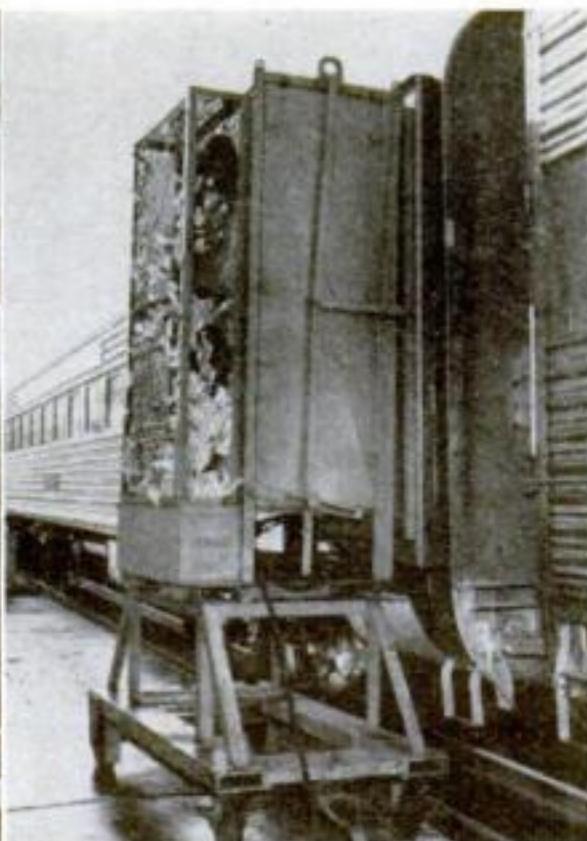
The cuffs are made of high-carbon steel that will defy attacks by files, saws, drills—even blows from a sledge hammer.

The inventor is Harry A. Tompkins, a mechanical engineer, of North Bergen, N.J. He worked out the design at the request of Dr. Sherwin Raymond, a Ridgefield, N.J., doctor, who got the idea while serving as an Army surgeon at Governors Island, N.Y., during World War II.

How you take them off ▶



AIR HOSE carried by rail worker dislodges refuse, dirt, and dust from carpets, ash trays, under the seats, and on the luggage racks.



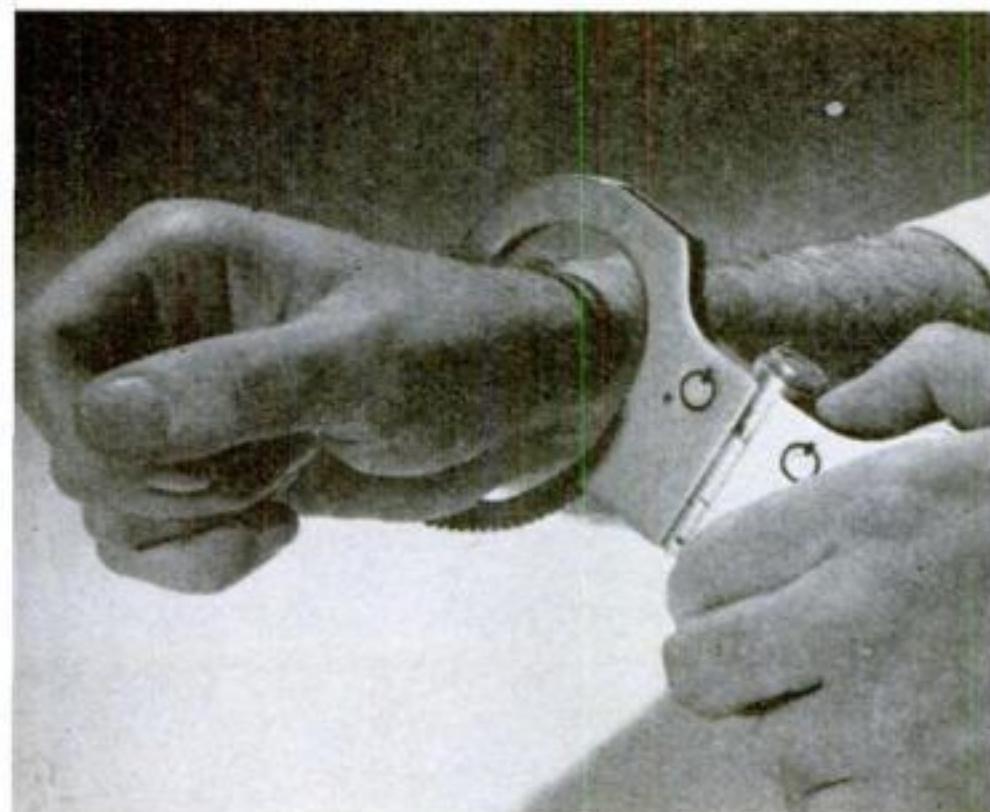
EXHAUST FANS backed to car door draw airborne debris into mesh receptacle. Debris drops into removable drawer when the fans are turned off.

Blowout for litter

A minor hurricane has been harnessed by the Santa Fe Railway to clean its cars after their Chicago-Los Angeles runs. The machine, called a Windjammer, consists of two 24-inch exhaust fans that can move 32,000 cubic feet of air a minute.

A man with an air hose passes through each car, dislodging dirt, dust, and refuse, which the fans pull out through the door into a waiting bin. The machine is then rolled up to the next car and the process repeated.

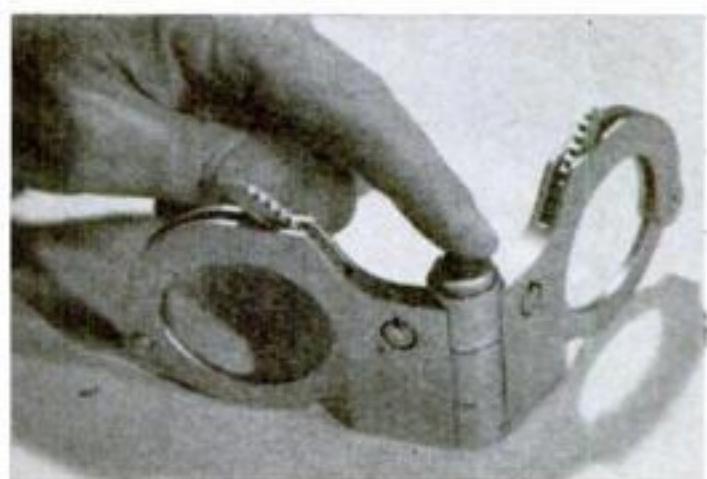
The method has proved so effective that rugs, previously washed four times a year, now need the service only once in that period.



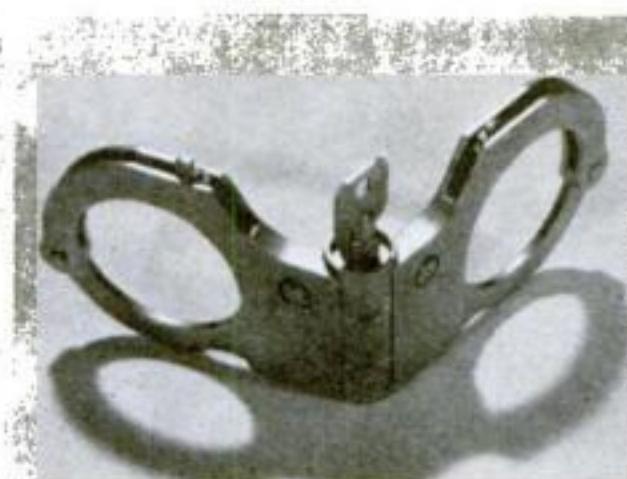
3. AROUND IT GOES on its pivot until it comes up on the underside and encircles the wrist. Ratchet teeth catch and hold.



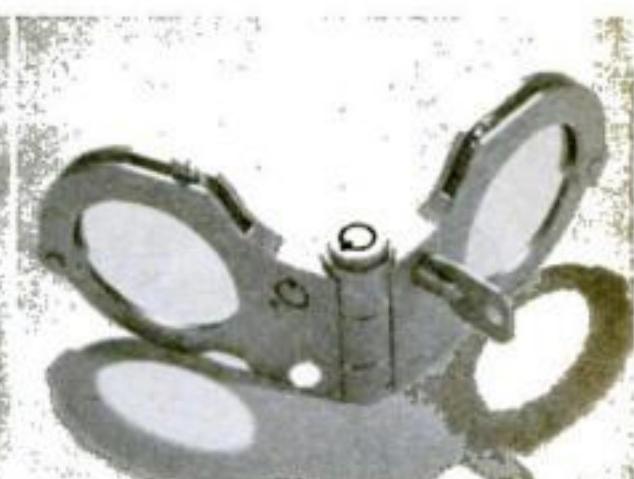
4. SHACKLED HANDS are held so close together that fingers couldn't reach locks even if they were holding the key.



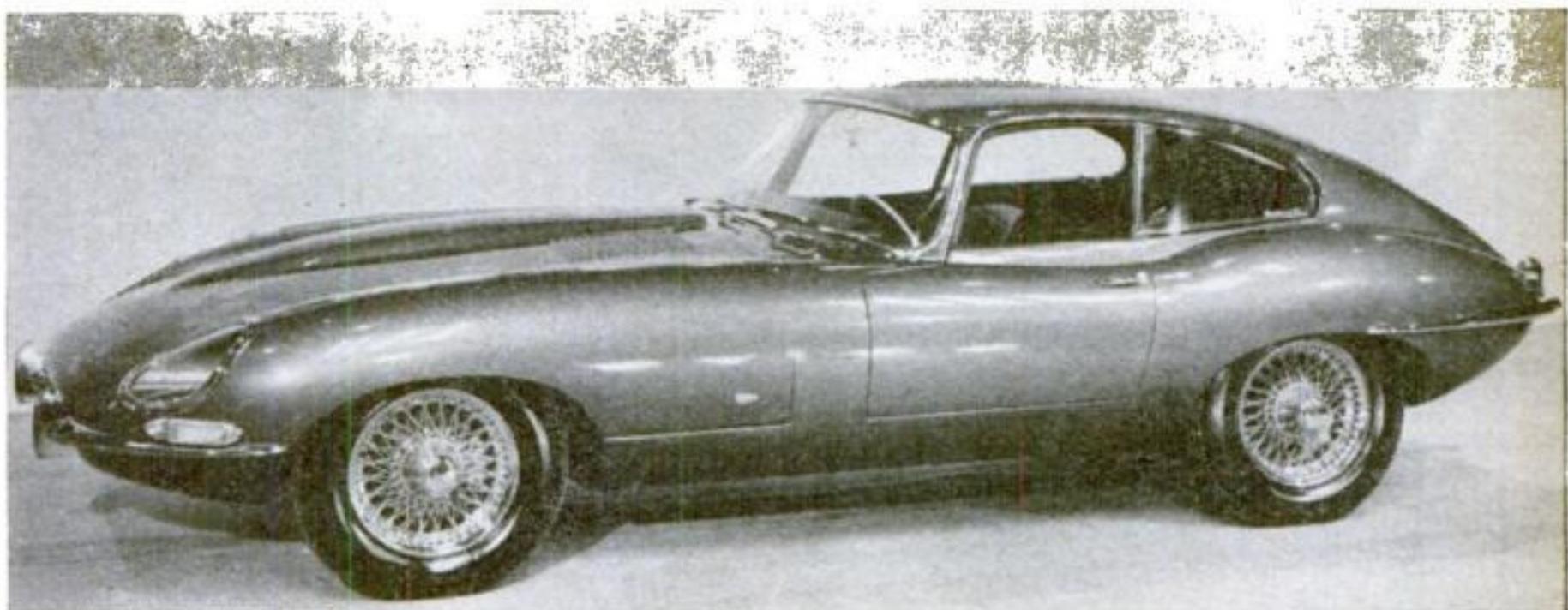
1. WHEN CYLINDER LOCK in hinge is pressed down, cuffs can be opened only with their key.



2. KEY IS FIRST USED to release cylinder, which opens safety catch on cuffs' double lock.



3. WITH CYLINDER RAISED, the key will open the individual cuffs one at a time.



Sportiest sports Jaguar

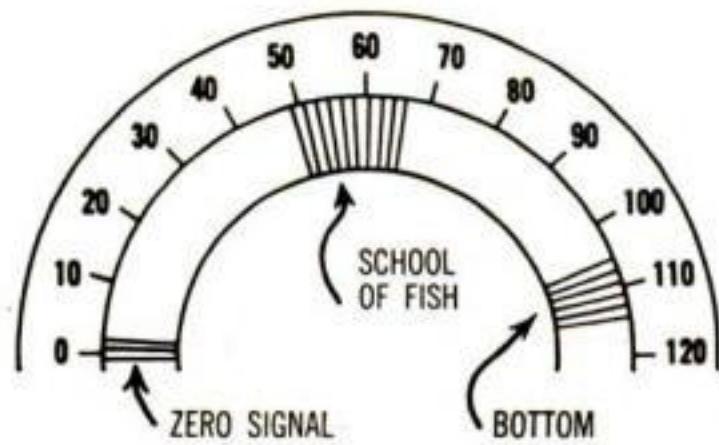
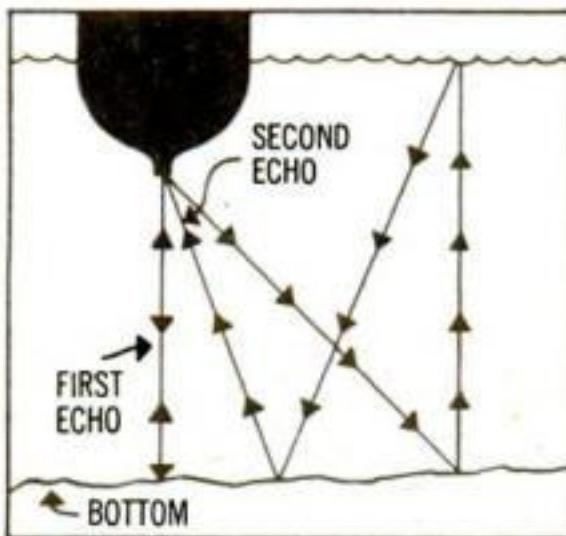
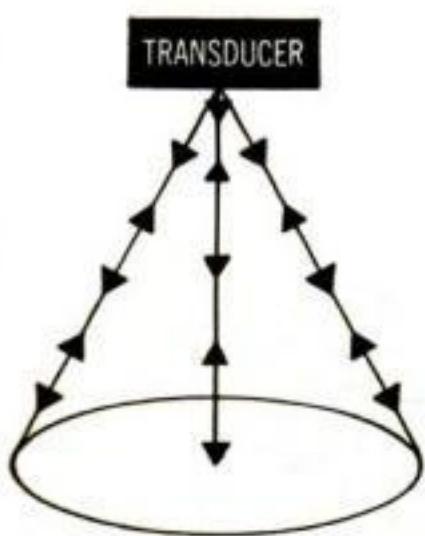
Breaking with tradition, the new E-type sports Jaguar has a wind-tunnel-tested Grand Touring body of monocoque design and all-independent torsion-bar suspension. The six-cylinder, twin-over-

head-camshaft engine displaces 3.8 liters (230.6 cu. in.) and delivers 265 hp. at 5,500 r.p.m. Top speed is 150 m.p.h. The car is over 14½ feet long and has an eight-foot wheelbase. Overall height is only four feet. Available in coupe or convertible form, it costs under \$6,000.



A compact depth sounder installed in their canoe increases the haul of these two fishermen.

How a 'Black Box' Can Help You Find Fish



SIGNAL TRANSMITTED by a depth sounder's transducer can be likened to a conical beam of light (left). Hitting a hard bottom, echoes are reflected at varying angles (right), showing spaced flashes on the indicator in the boat.

ECHOES FROM FISH are usually weak and do not interfere with bottom soundings. Large fish or schools of fish may show up as intermittent recordings between zero and bottom flashes, as shown in the drawing above.

By Hank Wieand Bowman
Nationally Syndicated Boating Columnist

THERE is no sure way to catch a fish short of using a sieve in a goldfish bowl—and even then you need a goldfish in the bowl.

But in my opinion, the greatest fish-catching tool since the invention of the barbed hook is one of those portable, transistorized depth sounders. Properly used, it can give you a huge advantage over anglers who fish "blind."

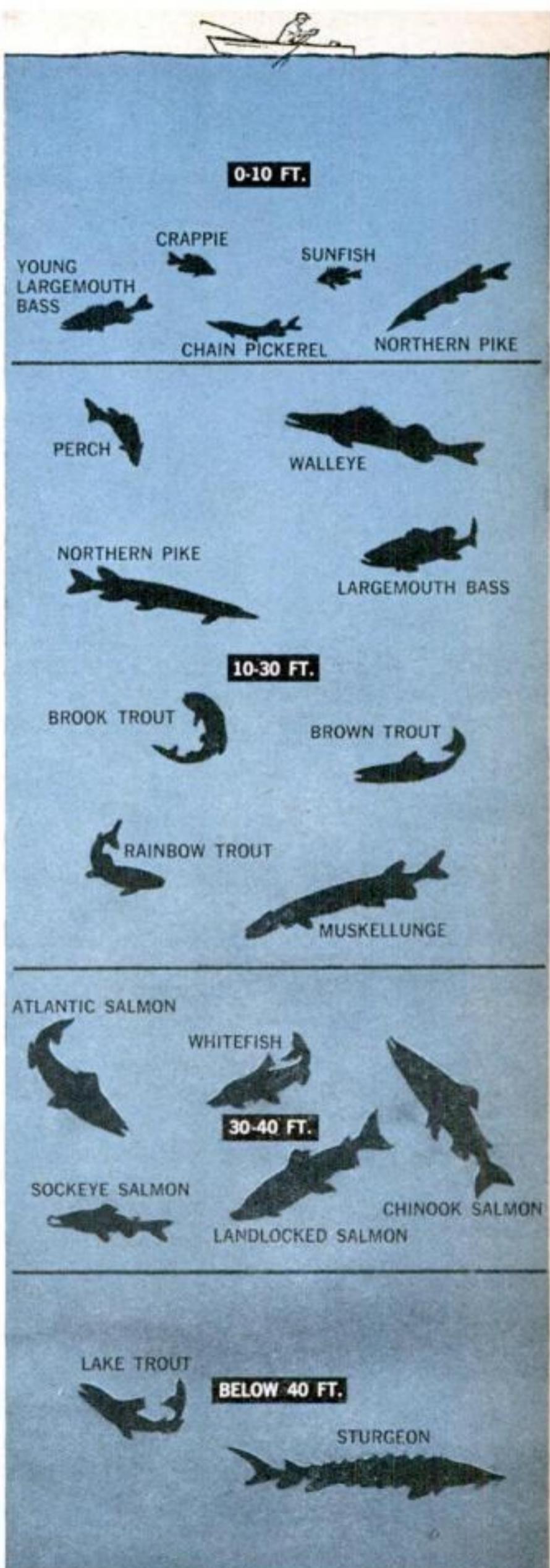
Don't place too literal an interpretation on the phrase "fish-finders" often used to describe these depth indicators. If you expect to use a portable depth sounder to spot one wily lunker swimming at a 20-foot depth in a 40-foot pond, you'll be disappointed.

Granted, depth sounders have long been used by commercial fishermen to locate schools of fish. But a sports angler will soon discover that all his portable electronic probe can do is tell him the depth of the water and the type of bottom. Both, as I will explain, are highly valuable pieces of information.

You don't look for fish. Some fishermen claim to be so astute at interpreting depth-sounding readings that they can spot a single fish and even determine its species. They'll have to prove it to me. Echoes from fish are fairly weak, since the only part of a fish that returns a usable echo is its bladder. Fish that have large bladders return stronger echoes than those with small bladders. No one but an ichthyologist is likely to be informed on the relative size of fish bladders, so I doubt that even the most experienced depth-sounder operator can tell a bluefish from a snook, or a lake trout from a sturgeon. In fact, even equipment manufacturers admit that when fish are swimming near the bottom, it's almost impossible to separate a fish echo from a bottom echo. But, as I will shortly explain, you *don't* have to zero in on a fish echo in using a depth sounder to improve your catch.

Portable depth sounders work quite simply. A device known as a transducer is mounted through the bottom of the boat, or suspended over its side. It's a crystal that translates electrical current to sound energy. The transducer transmits pulses of sound vertically downward

Depth distribution of fish in typical fresh-water lakes



PREDICTABILITY OF FISH HABITS is what makes the electronic depth prober work so well for fishermen. Certain fish thrive best at certain depths, as indicated in the chart above.

CONTINUED



IN SOUNDING BOTTOMS, fishery biologists cruise lakes holding a steady course and a constant speed. Such surveys would not be eco-

nomic without the aid of portable electronic depth probes; the devices enable them to cover 500 acres of water in an hour.

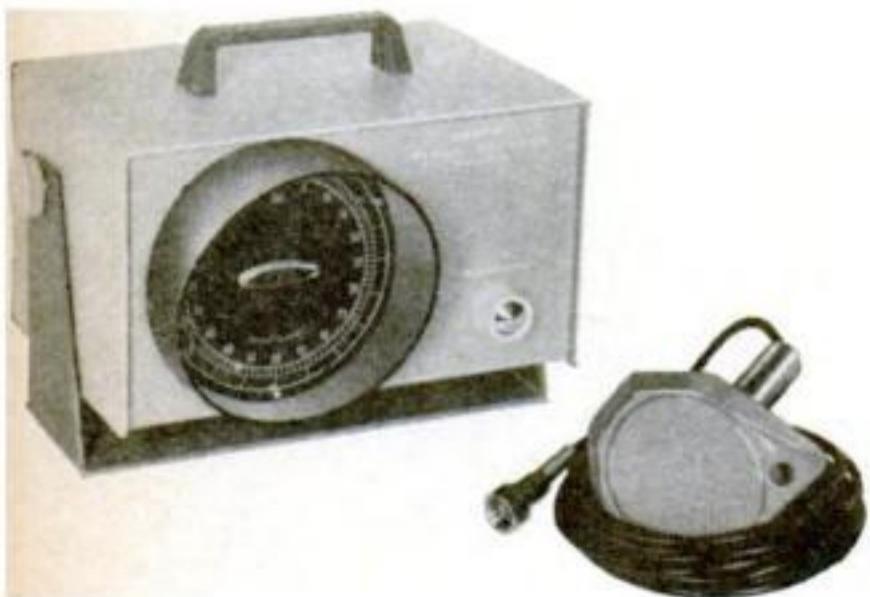
to the bottom of the waterway where the sound is echoed back. This echo is read off on an indicator or recording device that interprets time interval as depth. Depth measurements typically show on the indicator as bands of light.

Better than a local guide. No electronic knowledge is required to operate a portable depth sounder. Controls are usually limited to an on-off switch and a sensitivity knob. Most are calibrated in one-foot depth intervals, and record maximum depths of 80 to 120 feet. Any of these compact depth indicators, ranging from \$70 in kit form to \$100 and up fully assembled, can stack the angling odds in your favor ten to one. With a little knowledge of the habits of fish, you can pick the action spots better than the best local guide. An electronic probe and the right tackle can make yours the hottest rod on the lake.

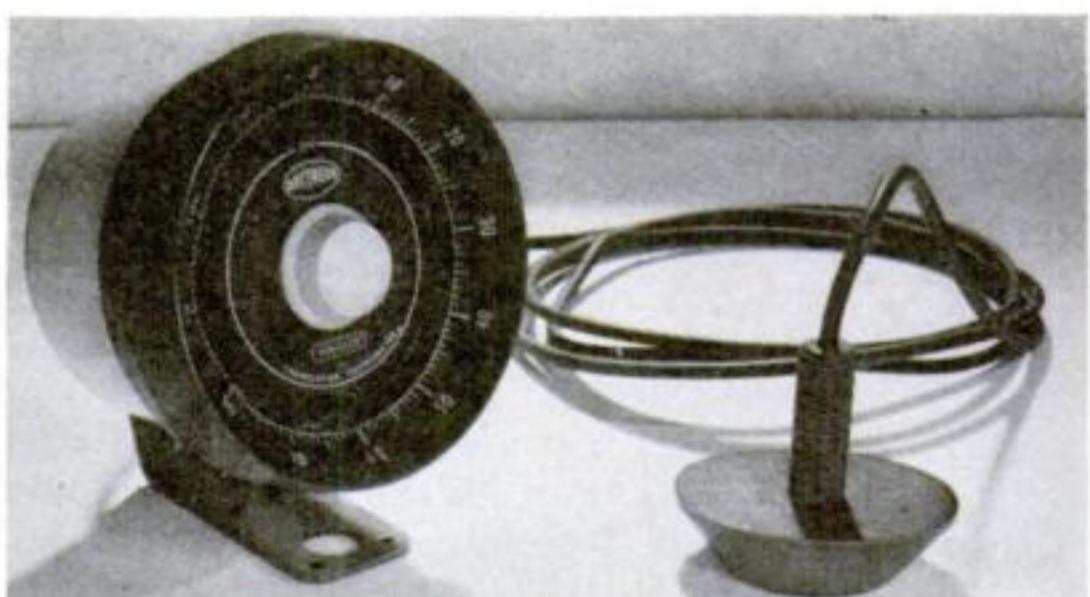
Charting lake bottoms. I first became

interested in the fishing use of electronic probes when I learned that Maine's Department of Inland Fisheries and Game had charted about 1,000 of that state's 2,500 lakes. It plans ultimately to do a thorough depth probe of every waterway in the state. Charting is part of an overall inventory of one of the state's most valuable assets. The survey has already saved thousands of dollars by insuring that hatchery-reared fish are planted in the proper environment.

Charts of lakes on which thorough soundings have been made have been printed in handy size and include data on physical characteristics of the lake and the fish in it. So popular is the project that fishing enthusiasts have bought 50,000 of these maps, which sell at five cents each. Other states are following the pattern, also using electronic depth-sounding gear—a necessity for such lake surveys.



HEATH'S DEPTH SOUNDER, one of several makes on the market, operates on six flashlight batteries. It sells for about \$70 in kit form and \$108 factory-assembled and ready for use.



SELF-CONTAINED MERCURY BATTERY powers Raytheon's portable Angler Fathometer. It will also operate on a boat's 12-volt DC system. Price is \$125, with battery \$9.95 extra.



DEPTH READINGS are transferred to lake survey maps. Kendall Warner, of Maine's Department of Inland Fisheries, is doing that here.

The same technique of charting fish habitat can be employed by fishermen anywhere. The only prerequisites are a boat and a portable depth finder, plus fishing tackle and a knowledge of lake types and fish types.

Consistent fish habits. Man has established many rules based on study of nature, and nature is usually courteous enough to follow the rules with a high degree of consistency. Finding fish with a probe is based on the predictability of fish habits. Generally fish can be expected to follow the rules discovered by anglers, game wardens, and biologists over the years.

Deep, clear lakes appeal to cold-water fish. Cold water sustains few plants, and the water contains plenty of oxygen at all depths all year round. Brook and lake trout and salmon are common in such lakes. During summer, deep, clear lakes often separate into temperature layers as the surface water warms. Various species of fish infallibly seek out different water depths. At about the 35-foot level, for example, there is often a rapid drop in temperature, and below this level red or sockeye salmon and whitefish are found. Lake trout and sturgeon usually laze around well below this, at depths down to 120 feet or more.

Shallow lakes, 40 feet or less in depth, don't have so wide a variation between top and bottom temperatures. The shallow lakes, usually rich in plant life, are lower in oxygen content since it is used up by decaying plant and animal material. Sunfish, northern pike, bass, crappie, chain pickerel, and white perch are

[Continued on page 196]

LAKEVIEW PLT., T4 R9, AND BROWNVILLE TWP.
Piscataquis Co.
U.S.G.S. Schoodic, Me.

Fishes

Salmon	Round whitefish
Brook trout (squaretail)	White sucker
Lake trout (togue)	Minnows
Smallmouth bass	Cusk
	Stickleback

Physical Characteristics

Area - 7168 acres	Temperatures
Maximum depth - 188 feet	Surface - 74° F. 150 feet - 46° F.

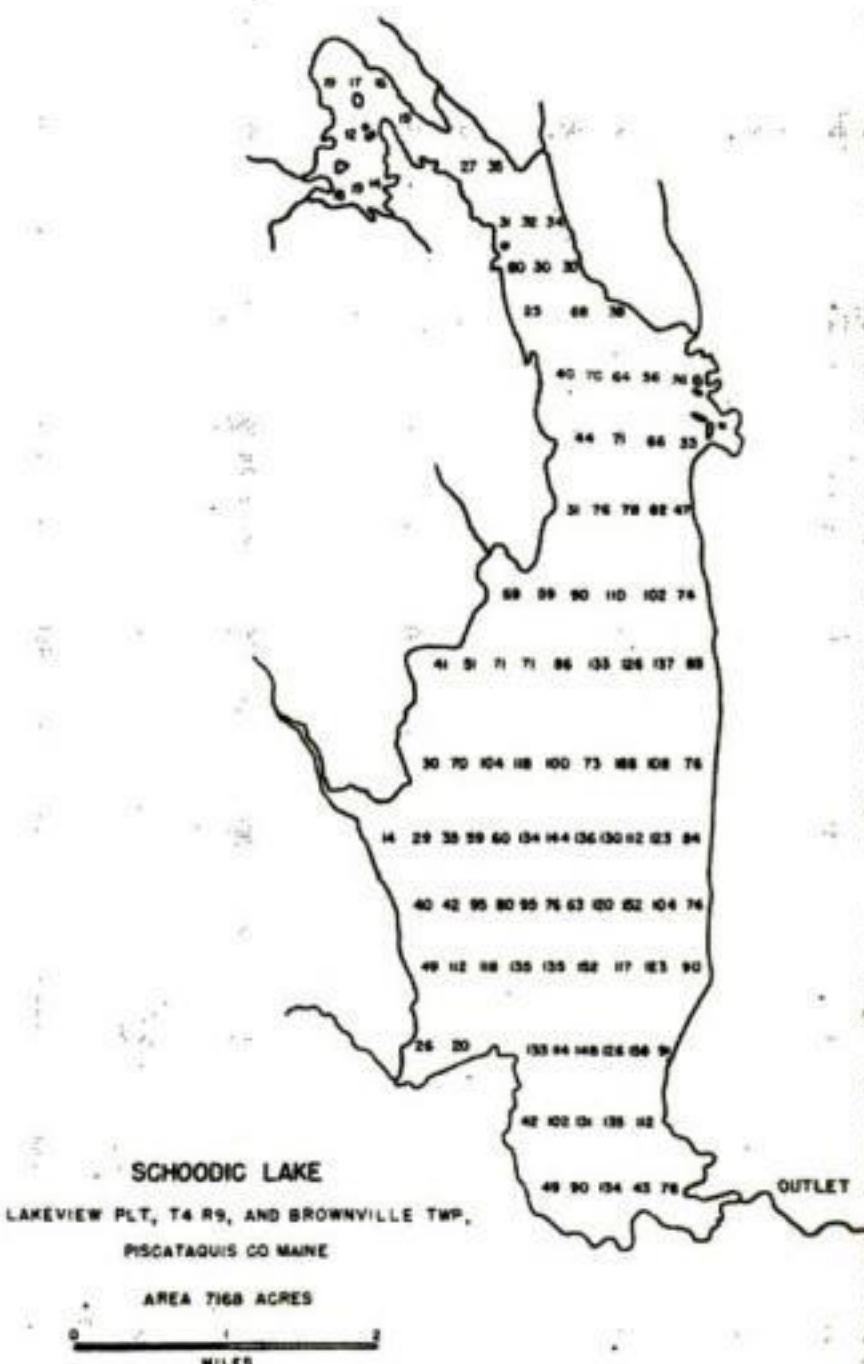
Suggested Management

Schoodic Lake is superior in water quality characteristics for salmonid fishes. It is one of the deeper Maine lakes, and contains abundant dissolved oxygen at 150 feet.

Management should be for salmon, brook trout, and togue, the most desirable cold-water species present.

Liberalized fishing should be permitted for smallmouth bass and other competing warm-water species.

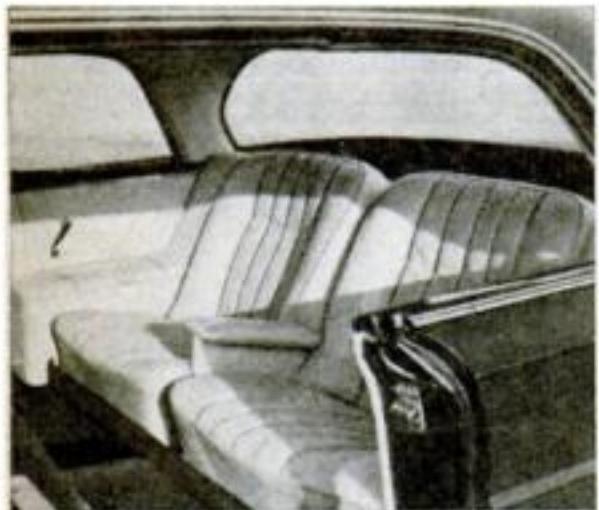
Surveyed - August, 1950
(Revised, 1953)



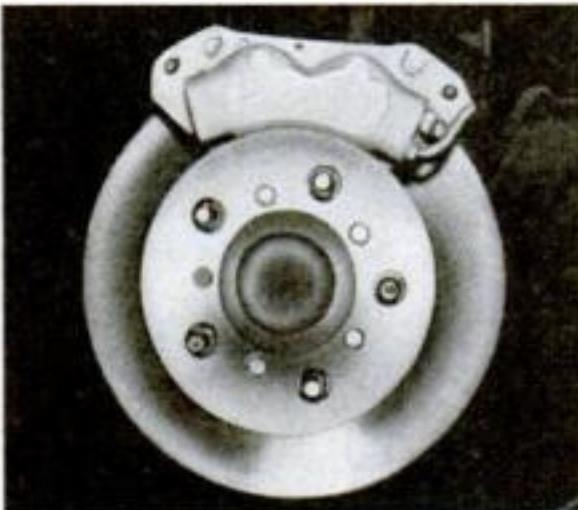
POCKET-SIZE SURVEY CHART of Maine's Schoodic Lake is reproduced above. General information about lake and fish is given on one side (top); depth chart is on reverse side (bottom).



INCREASED VISIBILITY is provided by more than 25 square feet of window area. Sliding sun roof is available at extra cost.



OPTIONAL REAR BUCKET SEATS can be ordered to replace the standard bench seat with folding armrest. Passenger and trunk space have been increased.



DISK-TYPE FRONT BRAKES help harness the car's 105-m.p.h. top speed. The successful earlier drum brakes are still being used on rear wheels.

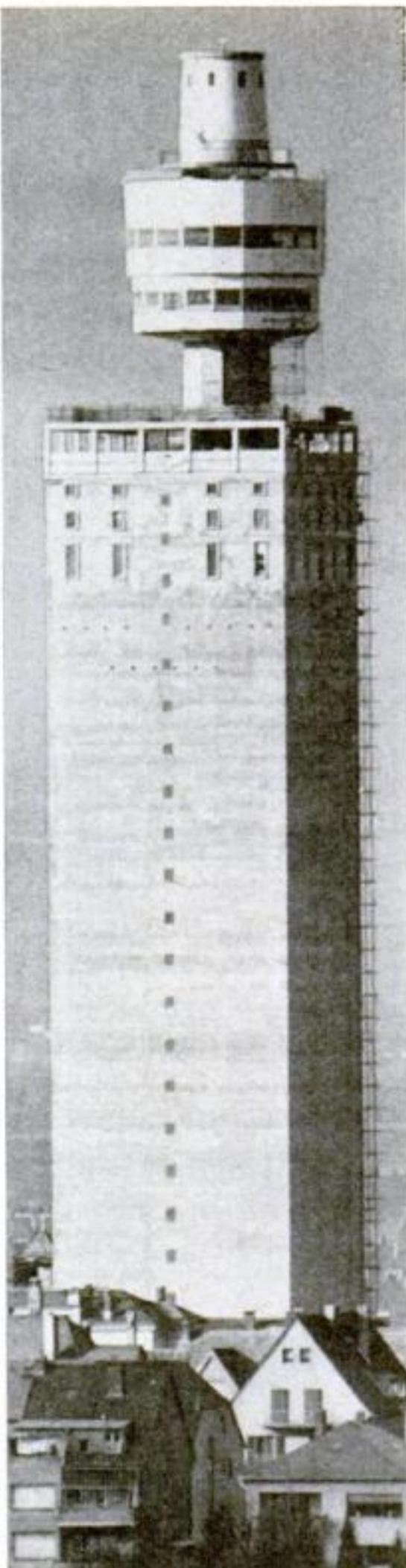
New Mercedes-Benz coupe

Passengers sitting in the back of the new Mercedes-Benz 22 SE coupe feel, with those extra-cost rear buckets, as if they're in the driver's seat. The car's fuel-injected six-cylinder engine develops 134 hp. and is mated to a four-speed, fully synchronized floor shift. Wheelbase of the four-passenger hardtop is 108.2 inches. Overall length is 182 inches and unloaded height is 57 inches. Prices start at \$8,695.



30,000 times more brightness

Little larger than an ordinary 100-watt light bulb (held by airman), a xenon-gas lamp mounted under the tail of a B-47 Stratojet bomber produces brief flashes of 3,000,000 watts on 2,500 volts of electricity. Visible from the ground at a distance of 80 miles, it helps technicians at Eglin Air Force Base, Fla., in checking out electronic tracking cameras on the Gulf test range.



Revolving restaurant

The towering grain silo of the Henninger brewery in Frankfurt, West Germany, now has a restaurant on its roof that seats 160. Guests enter by an elevator through the center.

The dining rooms rotate slowly, providing a complete circular view once every hour.



How Dreams Help Keep Us Sane

***With the aid of sleepy volunteers, science
is uncovering some fascinating facts
about what goes on in our minds at night***

By Lawrence Galton

ALL of us know we need sleep. But what we haven't known is that, even more than sleep, we need dreams. Without them, we'd go nuts.

Not even scientists suspected that until a few months ago. While men of every age have speculated on the mystery of dreams, it's only recently that scientists have stopped speculating. With completely new methods for looking into what goes on in our minds at night, they have been upsetting a great many old misconceptions and superstitions, discov-

CONTINUED

83

"Dreaming permits each and every one of us to be

ering one fascinating fact after another, and building up a whole new science of dreams.

Here's a look at what they've been finding out:

Research shows that all of us dream every night

And not just one dream, either. Each of us averages four to seven a night. We spend 1½ hours or more—about 20 percent of our sleep time—in dreaming.

That's clear from years of research. It got started in 1952 because of an accidental observation. While studying sleep cycles in infants, Prof. Nathaniel Kleitman and his associates at the University of Chicago Sleep Laboratory noticed that the tots' eyes kept moving under their lids after all other body movements had stopped.

To find out more, the Chicago investigators had adult volunteers sleep on cots in the laboratory and stuck tiny electrodes on their eye sockets so electric recordings could be made of eye movements. Night after night, every sleeper showed jerky eye activity. The jerky movements came in clusters several times a night. Still puzzled, the investigators stuck some more electrodes on the sleepers' scalps so brain waves could be recorded. And they found distinctive brain-wave patterns showing up whenever the jerky eye movements appeared.

Could the brain and eye activity indicate dreaming? It was only a hunch, but sure enough when sleepers were awakened immediately after a burst of rapid eye movements, they reported they had been dreaming. When they were awakened at other times—no dreams.

Although investigators haven't been able to monitor the sleep of everybody in the country, the evidence that everybody dreams every night is strong. For in all sleepers studied, consistently recurring dream patterns have been found, even in those who said they never dream.



Investigators stuck tiny electrodes on the sleepers' eyes and scalps to record eye movements and brain waves.

Why we forget many of our dreams



Ability to recall a dream may depend on whether you happen to be dreaming at the time you wake up.

We're ashamed of them—so we suppress them. That's been one theory. It may be true to some extent. But other factors have been uncovered.

Dreams tend to burst apart quickly. Drunks and drugged people are notorious for having trouble remembering. And dreams involve a low-grade type of mental activity, using brain mechanisms much like those used by the drunk and drugged. Lab work has shown that if you delay awakening a dreamer even just five minutes after the end of the eye movements, the chances of dream recall are greatly reduced. After another five or ten minutes, there's very little chance at all of recall.

So ability to recall a dream may depend upon whether you happen to be dreaming at, or very shortly before, the time you wake up.

There's a "tune-in" factor, too. Says Dr. Joe Kamiya of the University of Chicago: "I have observed prospective subjects who told me they very rarely dreamed, but who

quietly and safely insane every night of our lives"

began remembering dreams at home the day following my interview with them. So it seems to be a matter of attention—whether we are 'tuned in' to detect these private events."

Also, Dr. Donald Goodenough of New York State's Downstate Medical Center has found that some people dream so close to the waking stage, as shown by brain-wave recordings, that they think their dreams are only wakeful reveries.

And here's a bizarre sidelight: You hear now and then of people who claim they never sleep. Actually, some scientists believe that such people sleep without knowing it—because they dream they're awake.

Torture test: going without dreams

If we dream so much, is there a reason for it? To find out, Dr. William Dement and other investigators at New York's Mount Sinai Hospital put eight young men through what turned out to be a kind of torture test.

Night after night, as soon as the eight volunteers started to dream, as shown by eye movements, they were awakened. They were allowed to go back to sleep immediately after.

So the dream-deprived sleepers got just as much sleep as sleepers in other experiments who were awakened only after finishing dreams. But during the day the dream-deprived—unlike the others—became irritable and upset. They showed anxiety, had difficulty in concentrating. One left the study in apparent panic after three nights, and two others stopped short after four nights.

Even during the experiment, the sleepers had to be awakened increasingly on successive nights. They kept starting more and more dreams, trying to make up for the interrupted ones. One man, for example, began 7 dreams the first night, 10 the second, 17 the third, then 21, and finally 24 on the sixth and seventh nights.

And immediately after the experiment was over, the men made up their dream quota by dreaming more than usual until they had regained their emotional composure.

"It is possible," says Dement, "that if the dream suppression were carried on long enough, a serious disruption of the personality would result." Adds Dr. Charles Fisher, a psychiatrist who checked on the dream-deprived men: "Dreaming permits each and every one of us to be quietly and safely insane every night of our lives."



The dream-deprived volunteers became irritable and upset. They had difficulty concentrating.

How dreams help to guard our sleep

Aside from allowing us to be insane in bed so we can be sane by day, dreams also protect our sleep. Sigmund Freud had that idea many years ago, and recent research shows he was right.

Experimenters have rung bells, flashed lights, even splashed sleepers with water and found that often these disturbances are incorporated into dreams. The sound of an electric bell, for instance, becomes the ringing of a telephone or doorbell in a dream. When such a stimulus is woven into

a dream, the sleeper goes right on sleeping undisturbed.

Moreover, investigators have found that dreams have another protective action. "The dreamer can make all his wishes come true," says Dr. Kleitman. "Money, power, women, revenge, success—whatever he wants is his." Dreams, it seems, are often so enjoyable that we try to hang onto them and, in the process, often go right on sleeping despite noises and other disturbances that would otherwise wake us.

Dreams take time to happen

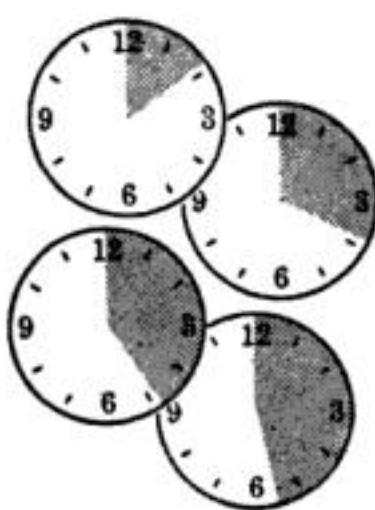


It takes you just about as long to tell a dream as it does to dream it.

It used to be thought that a dream was over in a flash, that somehow, in the dream world, time was compressed and everything happened instantaneously. Not so.

Dreams run anywhere from nine minutes to an hour. And the course of time often appears to be about the same as in real life. Investigators have found, for example, that a dreamer takes as long to relate his dream as he spent in actually dreaming it. At the University of Chicago, when one man dreamed that he went to the hospital where he worked, performed a chore, and then came back to the Sleep Laboratory, an investigator personally went through the motions of going to the hospital, doing the chore, then coming back. The time required corresponded to the length of the dream as shown by the dreamer's eye movements.

Dreams come in regular cycles



We start a new dream every 90 minutes or so—each longer than the one before.

We don't dream immediately upon going to sleep. First, for about 90 minutes, we drop into a deep dreamless sleep. Then we come up into a lighter stage of sleep and, with it, have a dream that averages about nine minutes in length. After that we go back into deep sleep again.

Successive dreams are increasingly lengthy. In an average night containing four dreams, the second runs about 19 minutes, the third about 24 minutes, and the fourth about 28 minutes. And the dreams come at fairly regular intervals—about every 90 minutes.

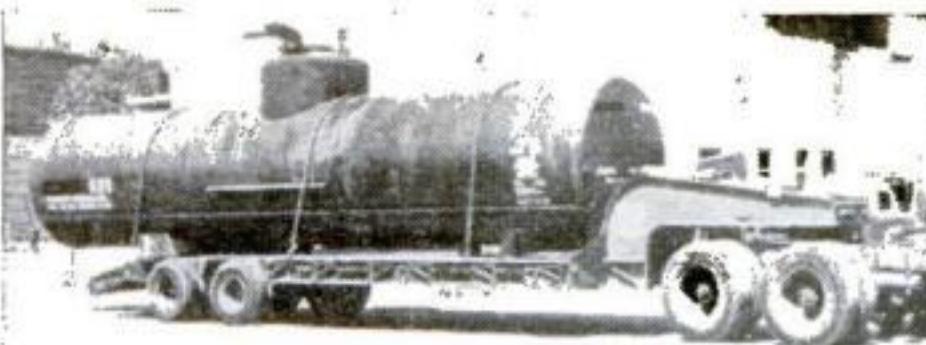
What's behind this spacing mechanism is unknown. But some scientists believe it's related to the cycle of rest and activity observed in infants. Infants generally sleep deeply for about an hour, then stir, either to awaken fully or to return to deep sleep again for an hour, after which the process is repeated. This cycle may increase with age, producing the 90-minute dreaming cycles seen in adults.

Can you tell when and what someone else—your wife for example—is dreaming?

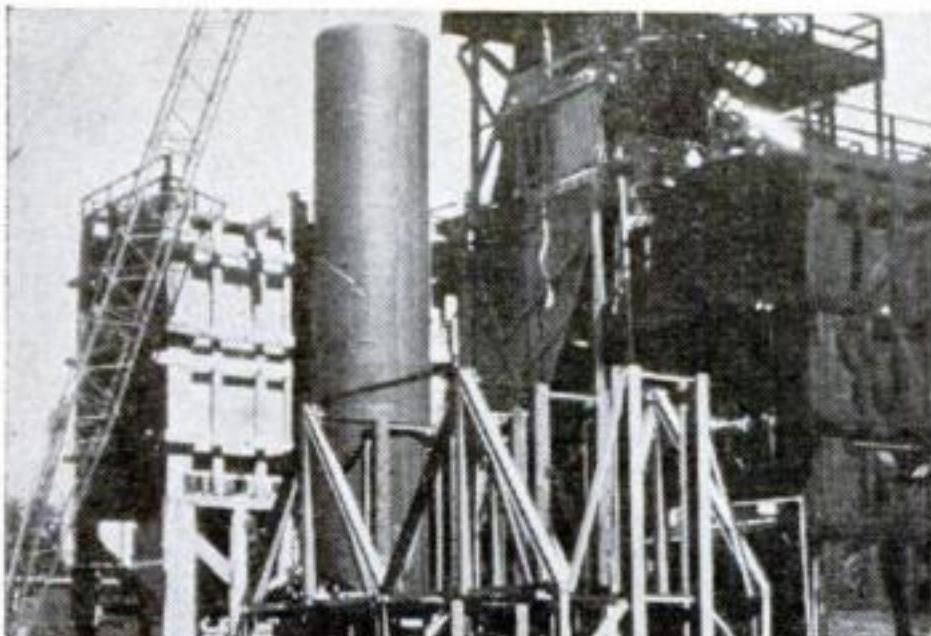
You can tell *when* by looking carefully at her eyes. If the eyeballs are moving beneath the lids, she's having a dream.

Don't be misled by body movements. Actually, before a dream starts, there is great activity—movements of the arms or legs, or turning over in bed. But contrary to what most people think, once a dream gets under way, body movements stop, except for very minor ones such as finger twitching. At

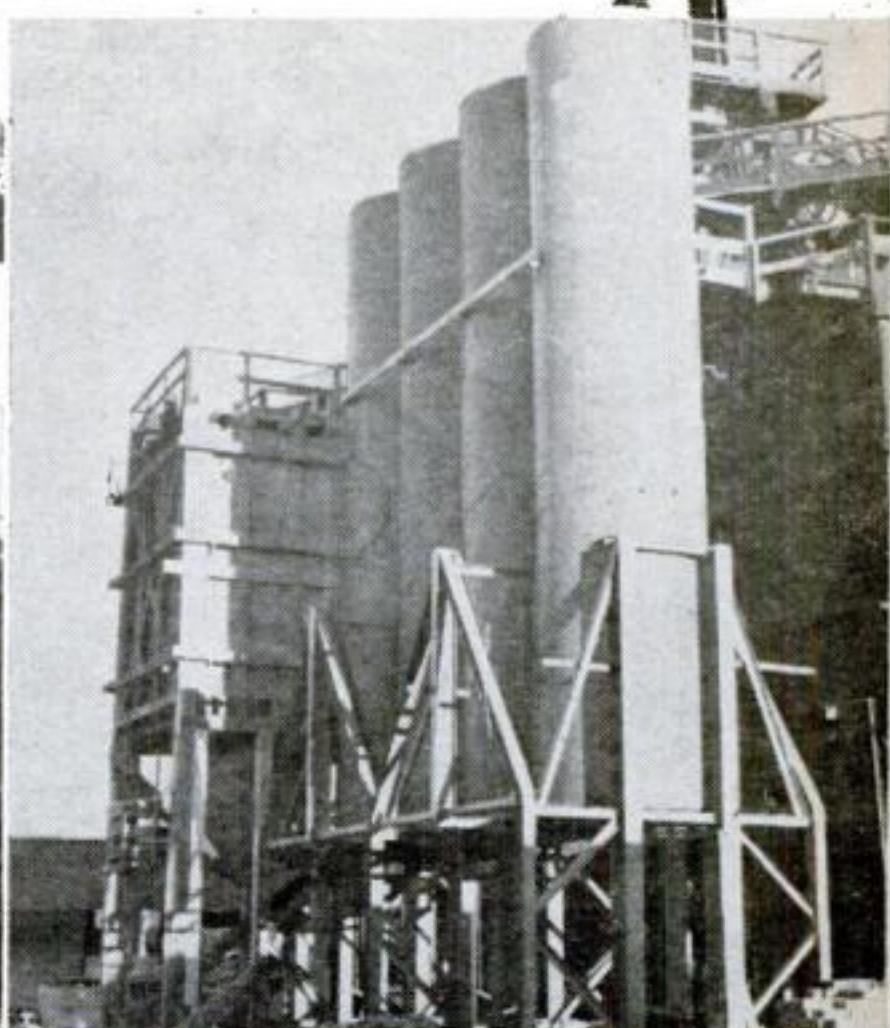
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Discarded tank cars . . .



. . . upended by crane . . .

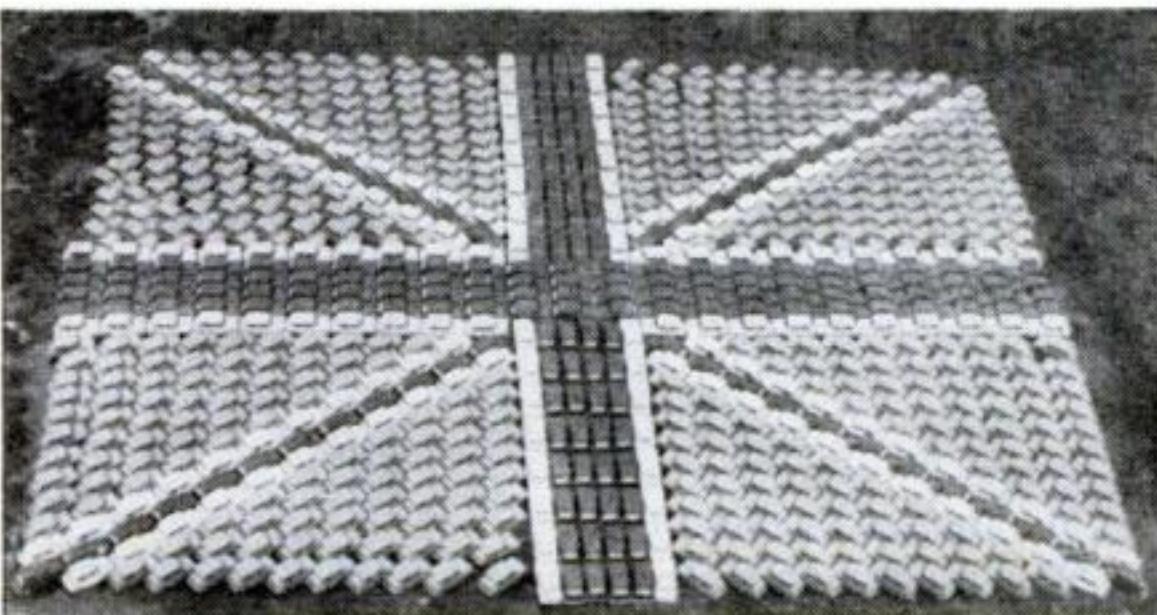


. . . become storage bins.

Storage bins made of railroad tank cars

When old wooden sand and gravel bins became a safety hazard, a building-materials firm in Hayward, Calif., replaced them with railroad tank cars. The cars, unfit for further rail service, were bought

for \$600 each, steam cleaned, and their domes replaced with welded plates. They were upended by crane and set permanently in a steel frame. Each holds about 35 tons of bulk material.



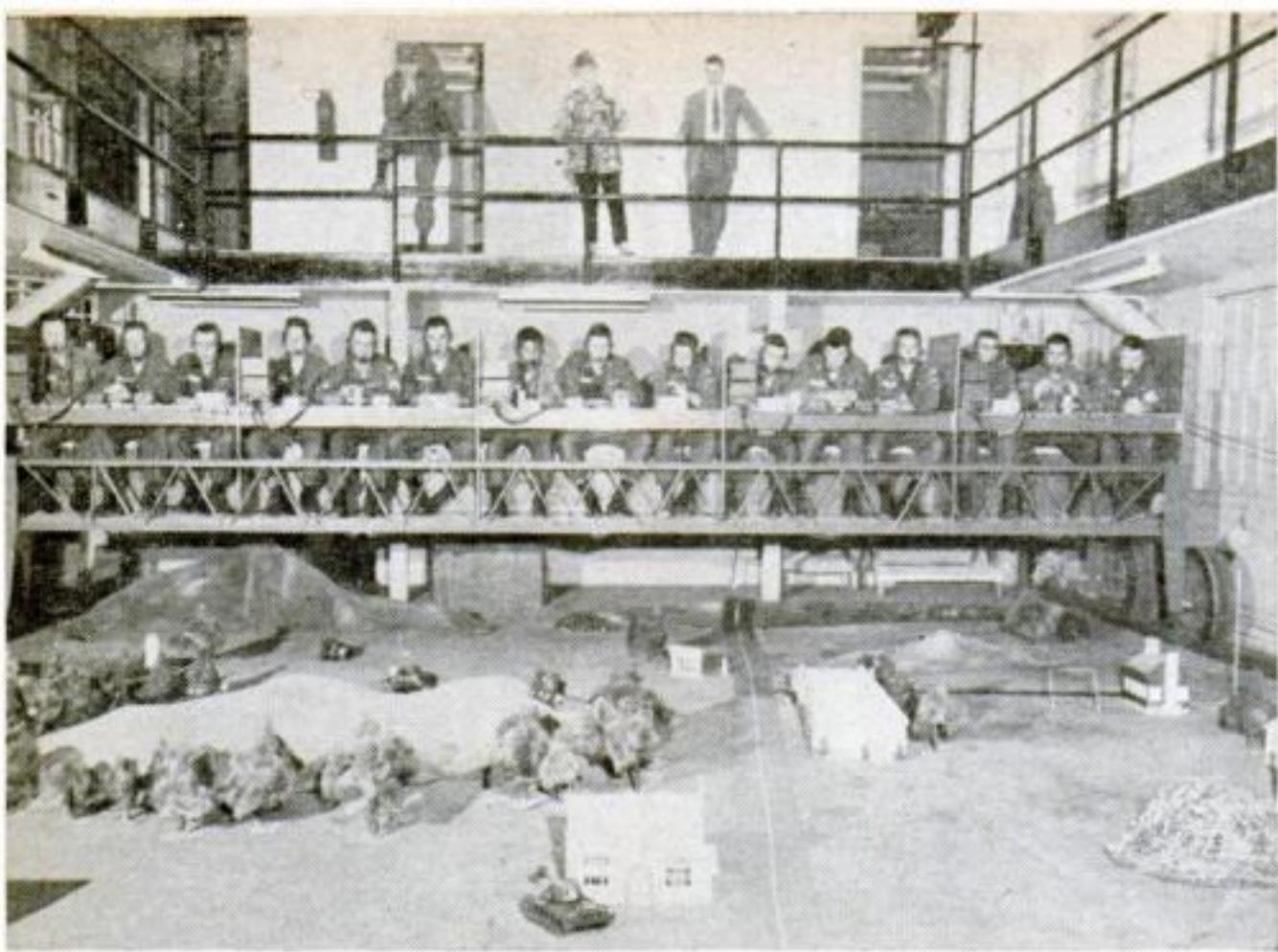
Patriotic parking

This huge British Union Jack was made by 804 Mini-Minors parked on a lot near Oxford covering almost an acre. The cars—204 red, 160 white, and 440 blue—were ferried from the factory by 50 drivers and parked by 10 others. The operation took them two full days, from dawn to dusk.

Muscle for howitzer

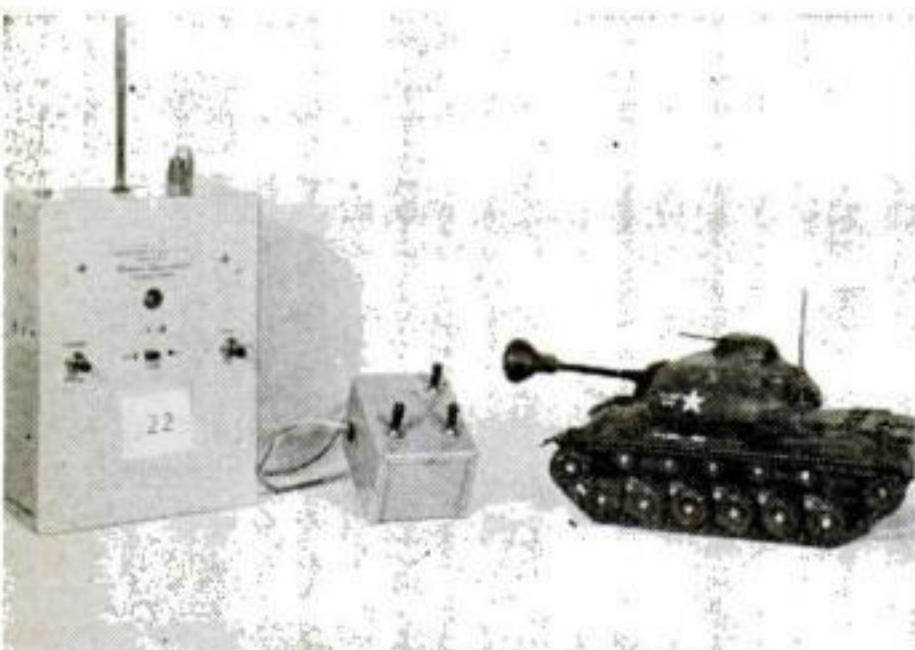
This air-droppable engine unit, designed to replace the six-by-six Army truck for towing a 155-mm. howitzer, is being tested at Fort Bragg, N. C. It slides over the closed trails of the weapon, making it self-propelled. The system can pivot on its own center, move into and out of gun emplacements, provide power for elevating and traversing the muzzle, ram a projectile into the breech, and furnish light and heat for the crew.





READY FOR ACTION, a gunner, driver, and tank commander sit in each compartment on the mobile platform. Platoon commander in center compartment directs operations of the group and controls movements of the platform three feet above the terrain board. Aggressor personnel are at other end of building. An enemy tank is seen in the foreground behind a house, waiting to ambush the friendly tanks. An observation deck overlooks the battlefield on four sides.

Miniature Battlefield Helps Train Tankmen

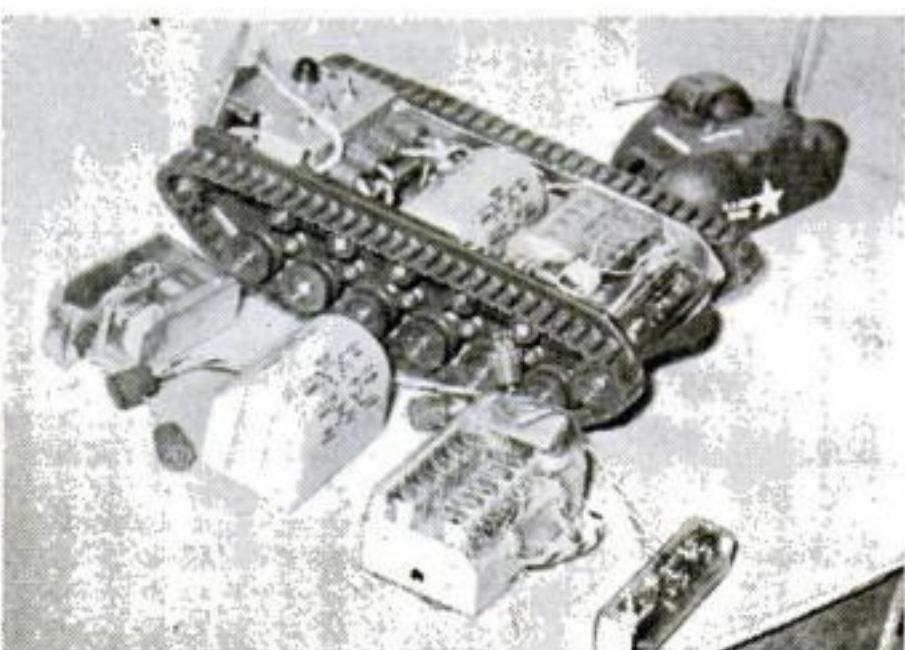


CONTROL BOX at left moves the tank in any direction. Control box at center turns the turret through 360 degrees, raises and lowers the gun barrel, and fires the gun. The tanks move at the same speed, in scale ratio, as real M48A2s and have same hill-climbing ability. Turns are made by locking one or the other of the tracks.

A PUSHBUTTON war is currently raging right in our own country. The combatants are two five-tank platoons, both remote-controlled.

The futuristic battles are being fought daily on a miniature battlefield 76 feet long and 28 feet wide, located in a wooden barracks at Fort Knox. The terrain board, complete with hills, rivers, trees, grass, roads, bridges, and buildings—all built to a scale of 1:25—simulates battle conditions for Armor School students.

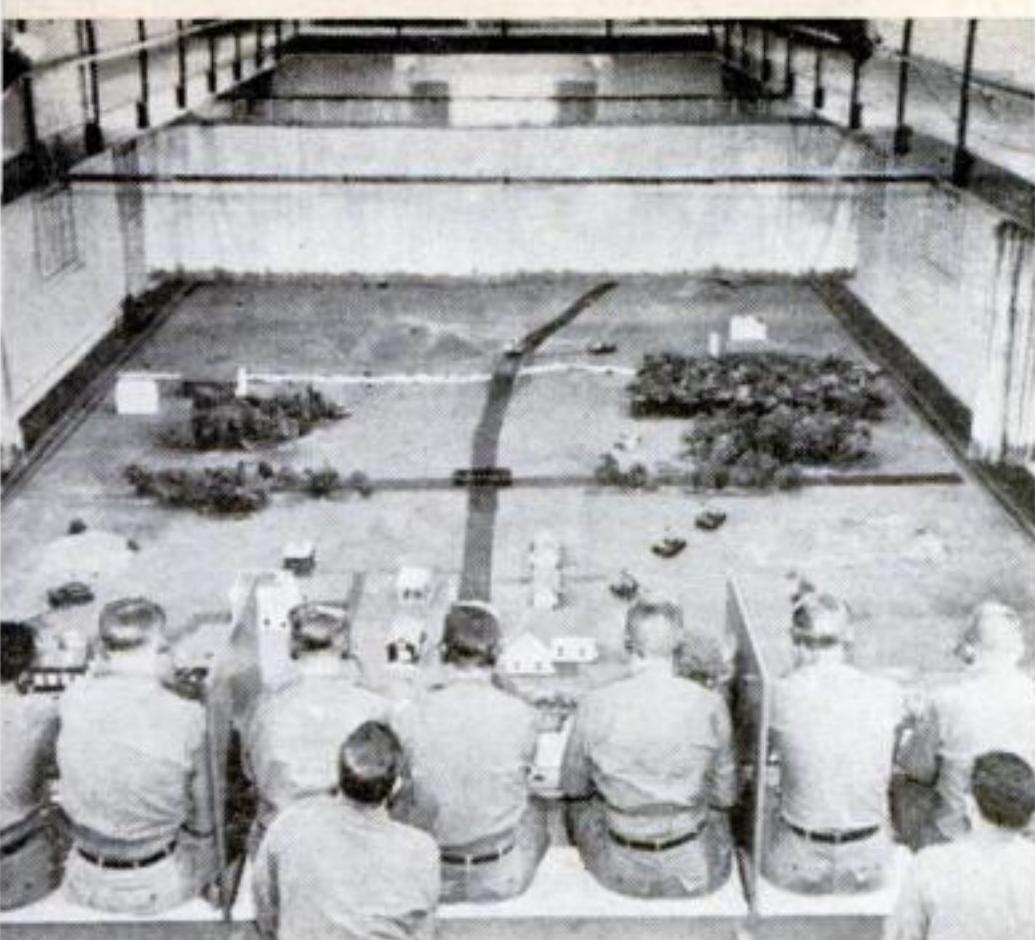
At one end of the building is a mobile



\$600 PLAYTOY: Removal of top reveals complex innards. Comparable parts shown outside are, left to right: driving mechanism, battery, radio receiver, and photoelectric amplifier (which disables tank when hit). Lifetime batteries must be recharged after every two hours of operation. Cost includes the controls.

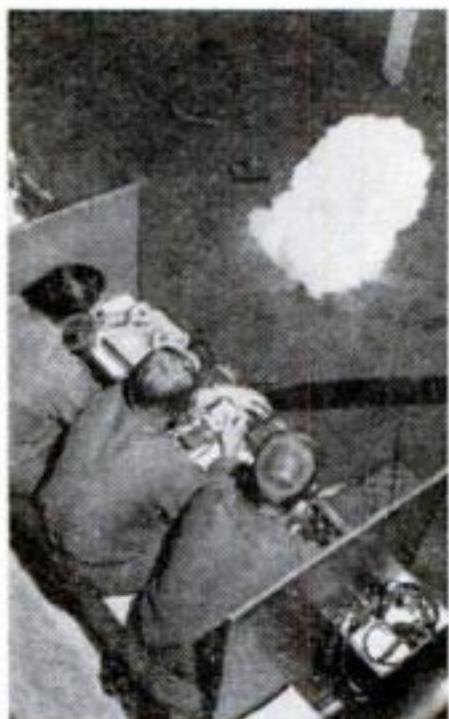
platform that rides on rubber tires, powered by a $\frac{3}{4}$ -hp. motor. On the platform, 15 students huddle over radio controls that operate the “friendly” platoon—M48A2 tank models. At the other end of the building a fixed bench seats 15 instructors who control the enemy tanks. Curtains at either end can be drawn to screen tank dispositions before a battle.

Each of the battery-powered tanks operates on a separate frequency between 24 and 29 megacycles. At the push of a toggle, a high-intensity light beam flashes



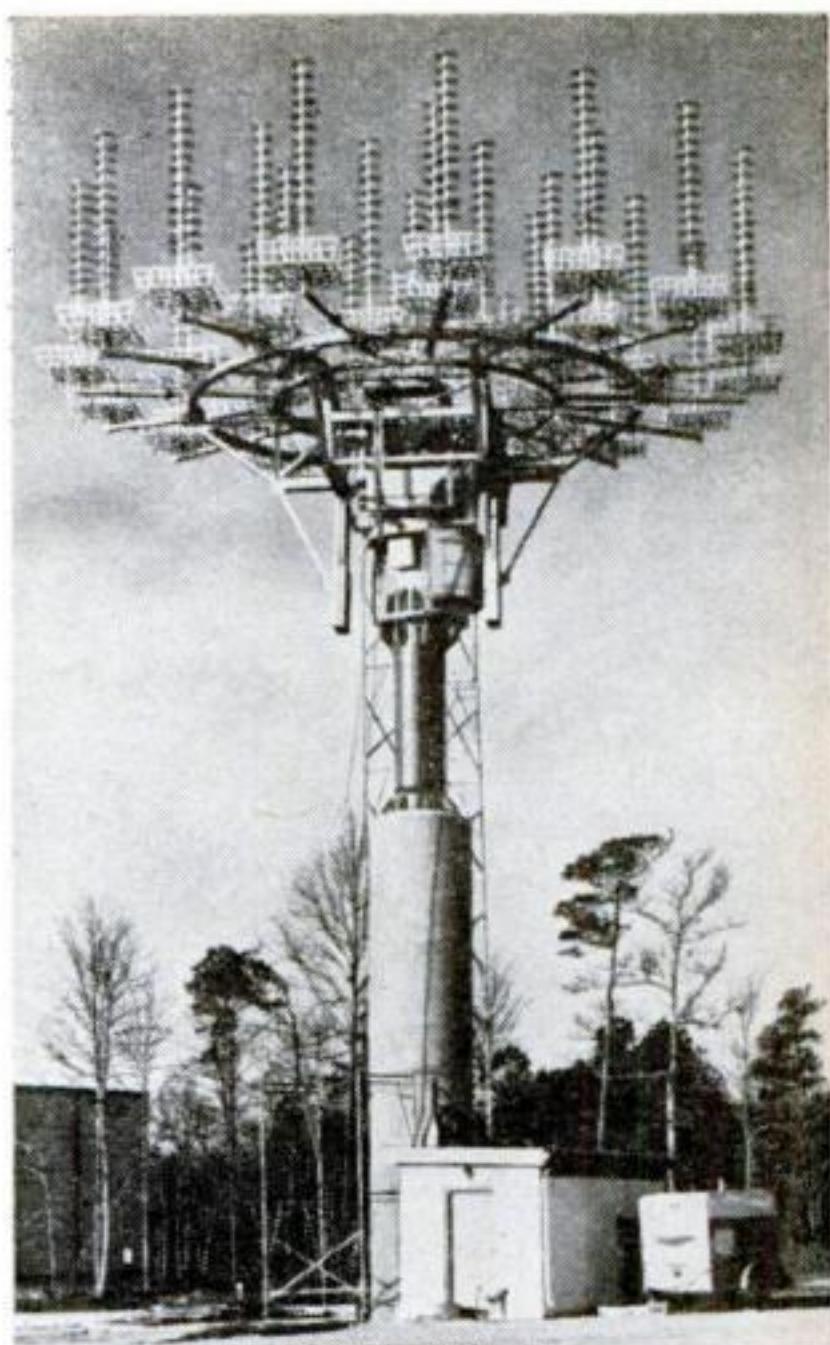
DEFENSIVE STRATEGY of the enemy can be concealed by drawing two full-width curtains. Here the trainees are advancing their tanks toward an enemy-held bridge. Whenever the friendly platoon loses three or more tanks, the engagement is broken off and a new battle is begun. An analysis by the instructor of both platoons' strategy follows completion of each exercise. Landscape can be shifted completely in about 15 minutes to set up a variety of problems.

MUSHROOM CLOUD rises as three trainees maneuver a tank into a nuclear-explosion area. Implanted charges of magnesium and flash powder form characteristic cloud. Specially bored air rifles fire tiny, harmless explosive pellets to simulate artillery fire. Concealed firecrackers, the battlefield's "land mines," are remote-triggered by instructors.



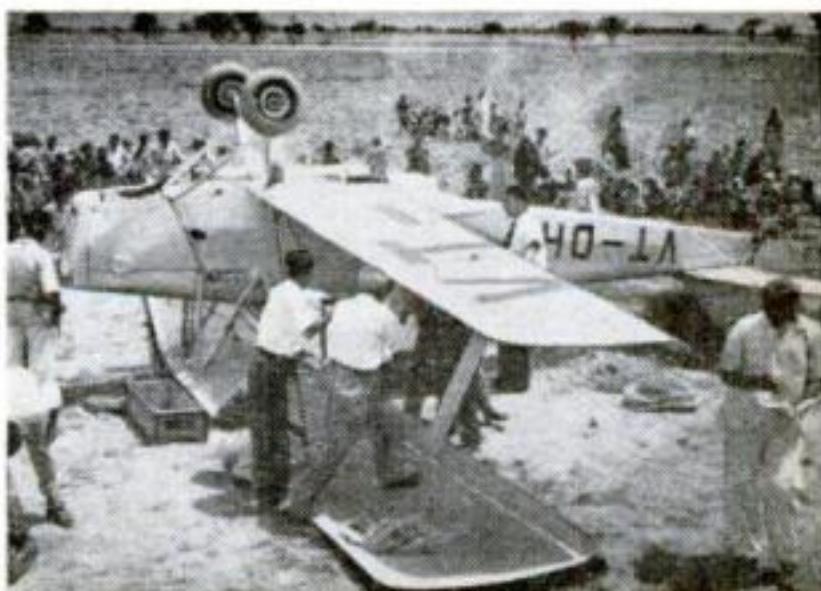
from a tank's guns to simulate firing. Installed on each tank, below its support rollers, are photoelectric cells. When a light beam from another tank strikes a cell, the tank becomes inoperable and a red light at the rear signals the hit. A manual reset switch must be closed to make the tank operable again for the next battle.

Total cost for development and construction of the miniature battlefield was under \$24,000, far cheaper than full-scale maneuvers with armor units.



Space-vehicle tracker

This unusual antenna has been installed at NASA's Wallops Island station in Virginia to receive messages sent back from deep-space probes. General Bronze Corp. designed it as a cheaper replacement for much larger dish antennas, but its reception is limited to certain frequency bands.



Flipped flyer

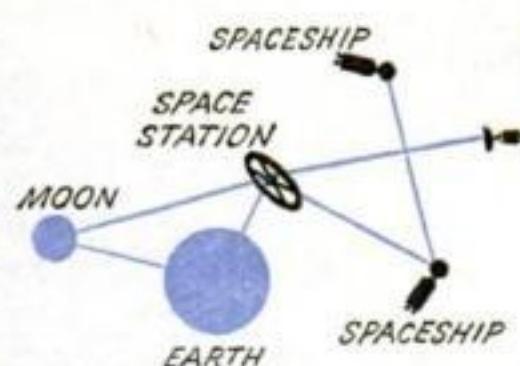
Nosing over during an emergency landing near New Delhi, India, this light plane came to rest flat on its back. Miraculously, the plane was practically undamaged and its passengers walked away without a scratch.

By adapting the old heliograph, a new signaling system would serve future explorers beyond the earth

Spacemen May Talk on Beams of Light



Flashing messages through space



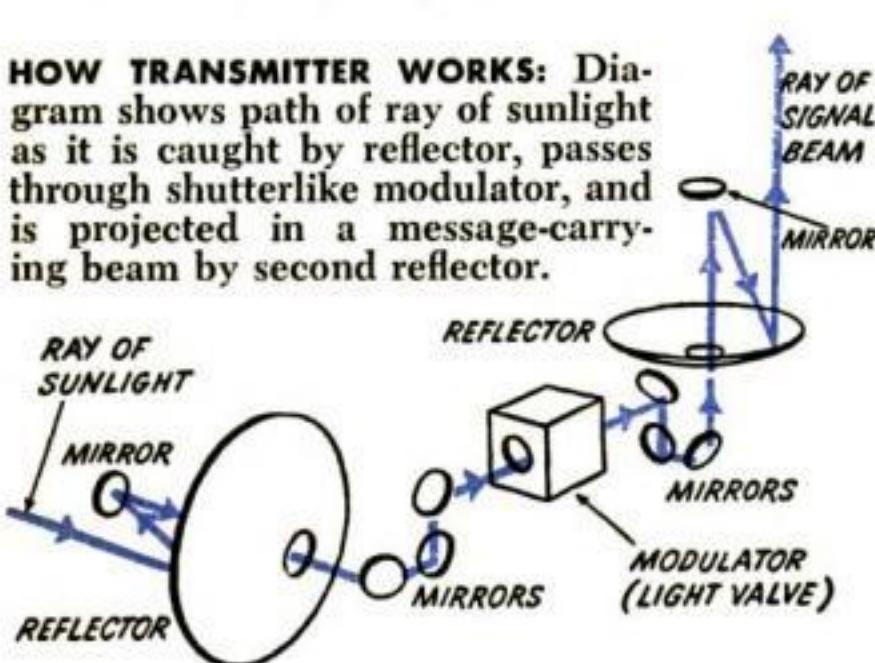
SOCOM SYSTEM would link spaceships and bases as in diagram. Transmitter, in large view, blinks out a message. Shown by itself for clarity, it would actually be mounted on a spaceship or space station.

By Wesley S. Griswold

WILL lights twinkle across space to carry messages between the outposts of tomorrow's interplanetary explorers?

That is the prospect raised by the re-

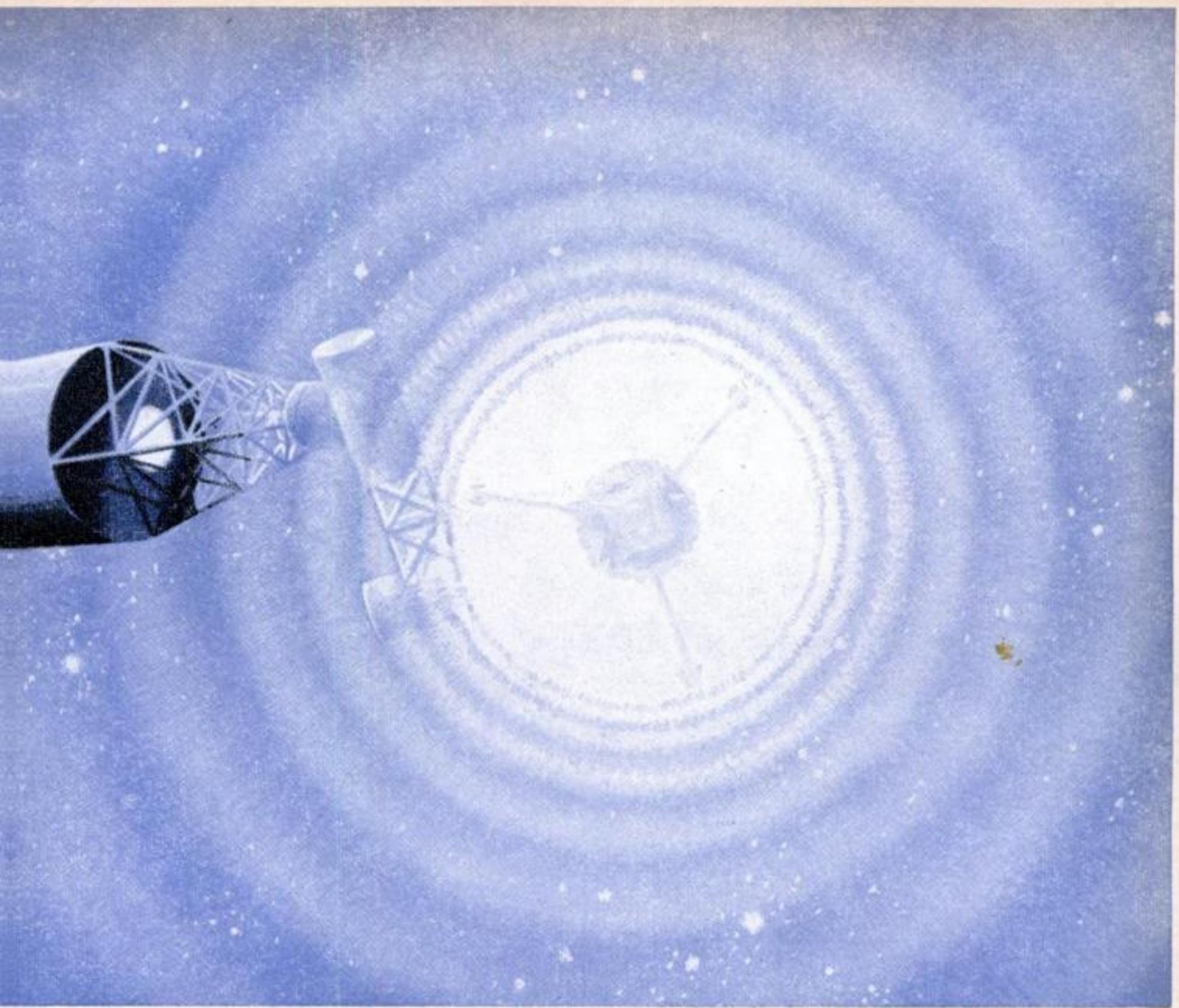
HOW TRANSMITTER WORKS: Diagram shows path of ray of sunlight as it is caught by reflector, passes through shutterlike modulator, and is projected in a message-carrying beam by second reflector.



cent successful trial in California's Mojave Desert of a long-range system of signaling with sunbeams and mirrors. Under development for the Air Force, it is called Socom, for solar orbital communications.

Socom amounts to an ultra-sophisticated, Space Age adaptation of the heliograph. This old-time signaling device consisted of a pair of adjustable mirrors, to reflect a beam of sunlight toward any point, and a key-operated shutter that interrupted the beam to form dots and dashes of the Morse code. Applied first by the British army in India and later by our own in the southwest U. S., it was reliable only in the few relatively cloudless regions of the earth.

In contrast, Socom is to operate in space, where the sun always shines. It can be designed to carry spoken messages



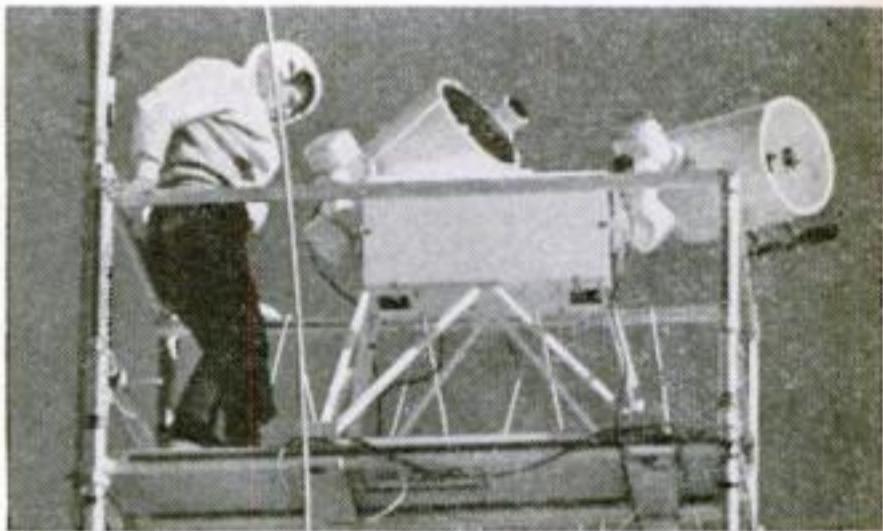
as well as telegraphic ones. It incorporates such electronic refinements as automatic sun-tracking and beam-aiming.

Maximum range of a single space heliograph would be 10,000,000 miles or more, according to its designer, Electro-Optical Systems, Inc., of Pasadena.

Socom's transmitter has three principal parts. A dish-shaped reflector collects the sun's rays and, with the help of a small auxiliary mirror, concentrates them in a narrow beam. An electrical light valve called a modulator, replacing the old-style shutter, impresses a message on the beam. Then a second reflector projects the beam toward a distant receiver. Small, angled mirrors form optical "universal joints" so that the two larger reflectors can be aimed in any direction.

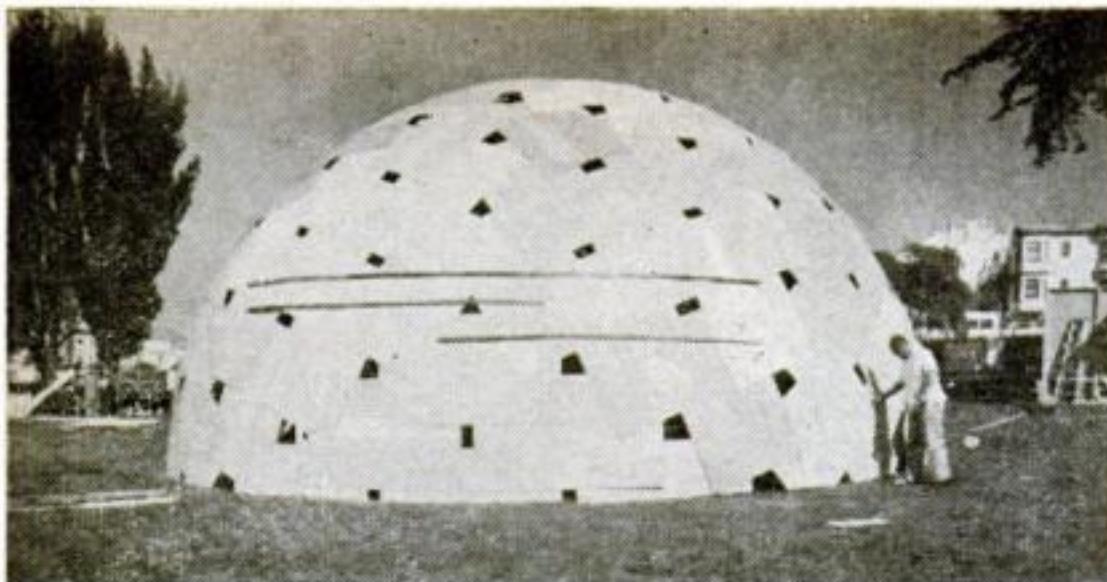
The design of the modulator varies, ac-

[Continued on page 200]

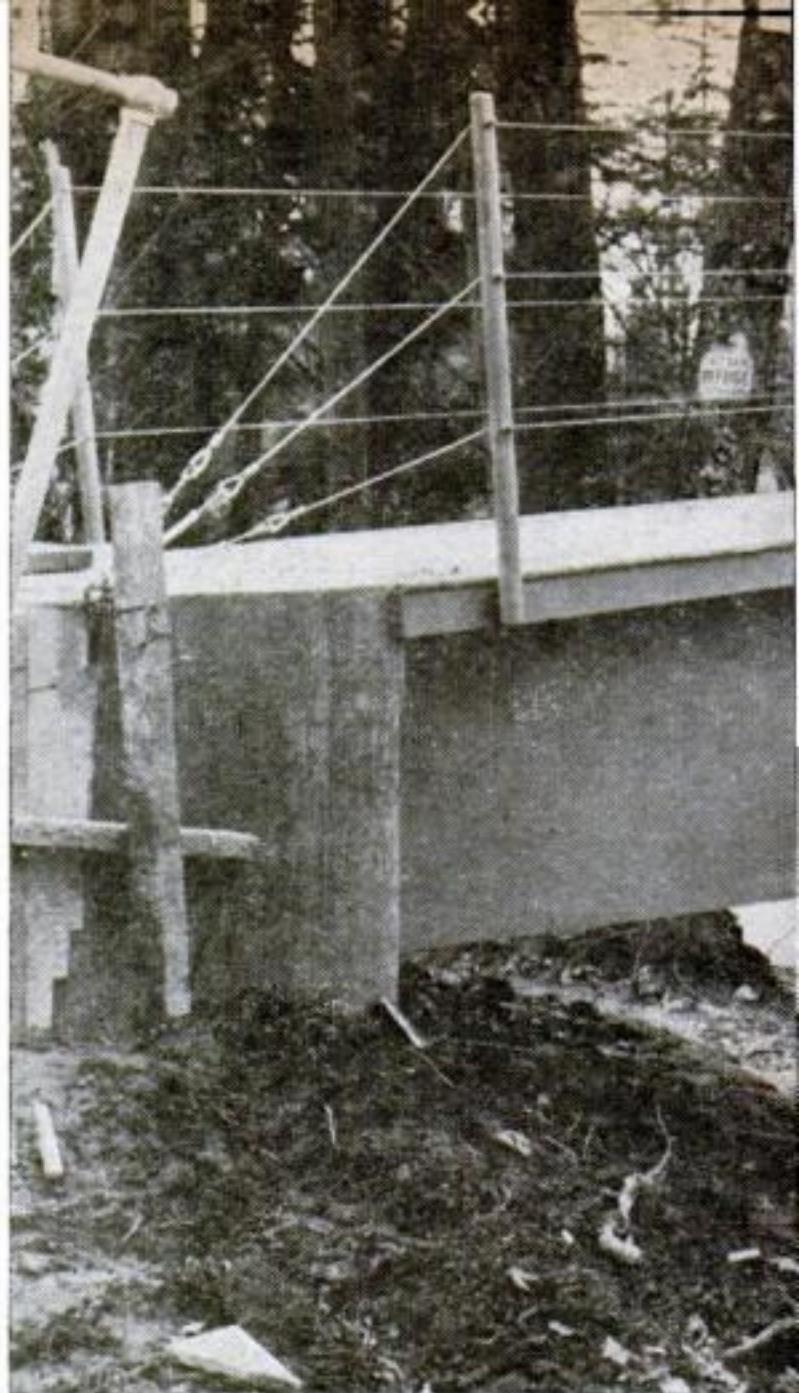


IN TRIAL, transmitter on 30-foot tower, above, flashed messages eight miles across desert to receiver, right. Light filters simulated distance up to 10,000,000 miles. Reflectors of test rig had one-foot diameter; for maximum range, full-scale ones would be larger.





NUTS AND BOLTS secure 135 sheets of quarter-inch plywood at the corners to produce the shingled effect shown above. The 39-foot-wide dome was built, along with a smaller, 25-foot-wide version, for the San Francisco Arts Festival.



Here two plywood box beams are

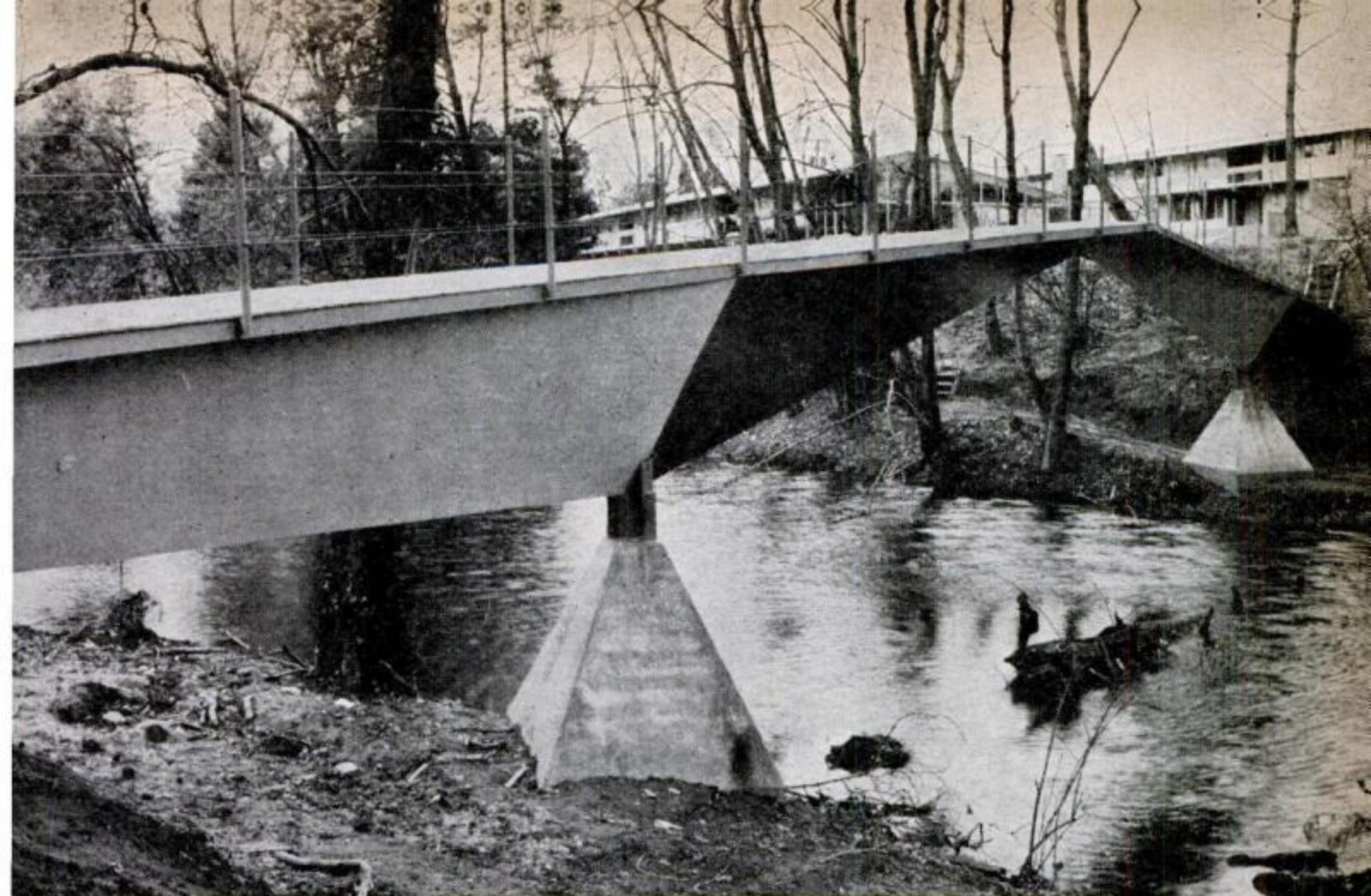
WING-SHAPED plywood roof in Estes Park, Colo., lodge at left is supported at its two lower corners by heavy concrete buttresses. The walls don't bear any of the roof weight.



CLEAR-SPAN 4-H BUILDING (below) at the Southwest Washington fairgrounds has a rigid

arch structure, roof, and walls made of plywood. It's the first of its kind in the country.





cantilevered across a river to form an interesting footbridge at Reed College, Portland, Ore.

LAMINATED wood—or plywood, as we generally call it—is as old as the tombs of the Pharaohs and modern as tomorrow's architecture.

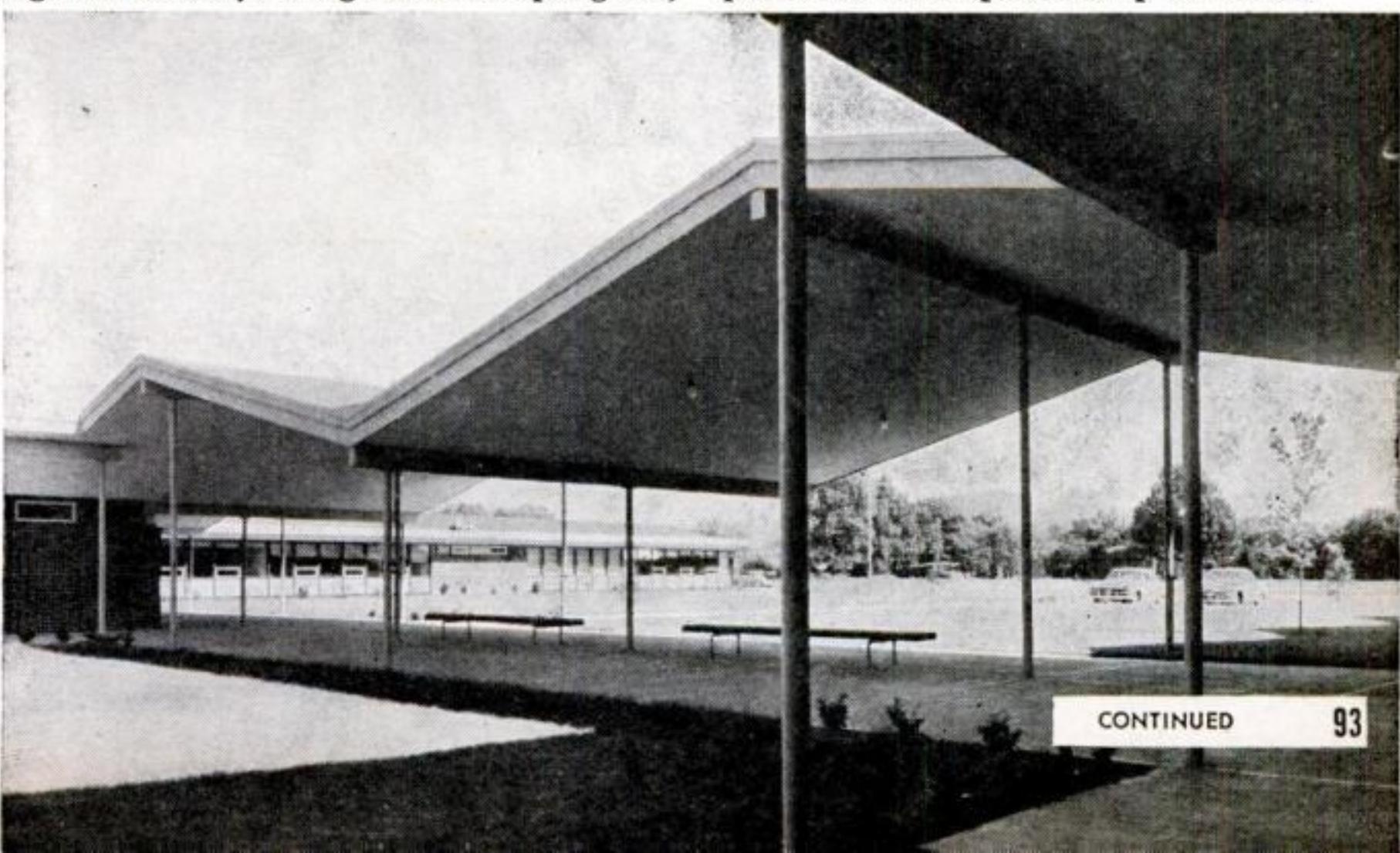
Though small samples of laminated wood thousands of years old have been discovered, only in recent years has ply-

FOLDED-PLATE PLYWOOD ROOFING over buildings and walkways of high school in Springfield,

wood come into its own in the building trades. Its main advantages: strength and lightness. Also, it can be laminated in jigs to almost any desired shape, making possible the unusual or even bizarre architectural effects shown here.

Adding to its popularity are newly

Ore., is supported by pipe columns, beams, and partitions. Roof spans are up to 34 feet.





TEN PLYWOOD HYPERBOLIC PARABOLOIDS, or double-curved sheets, over a parasol-type rib structure form this pagoda-like pavilion beside a pharmaceutical company's swimming pool.

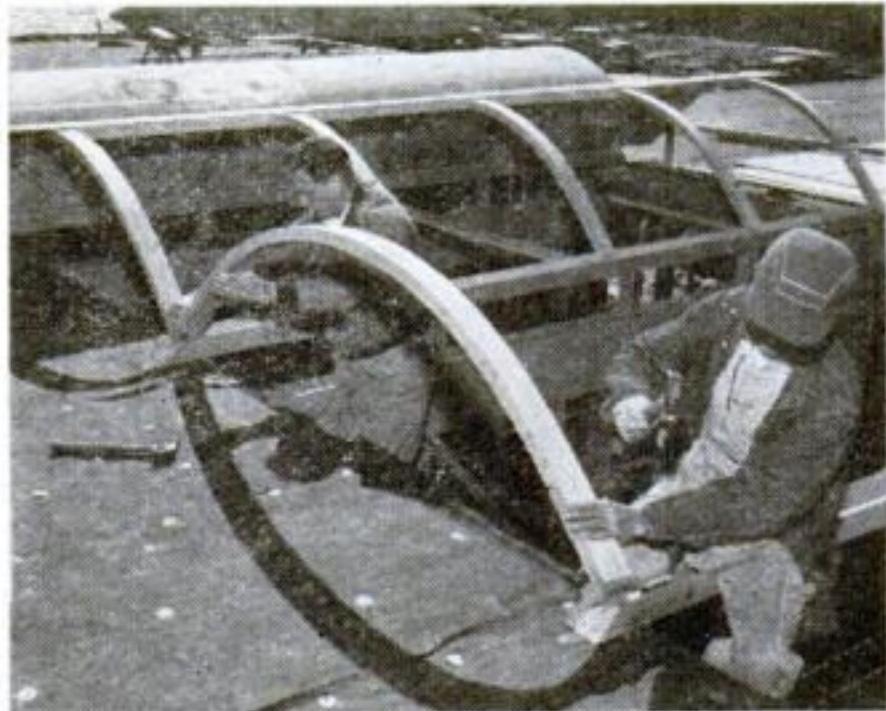


UNUSUAL GARDEN STRUCTURE was made possible by vaulted plywood panels. Frame is of four-inch steel H columns on eight-foot centers.

developed beauty treatments. A striated, or combed, surface is manufactured for indoor paneling. Shot-blasting produces an unusual finish. Or the wood can be V-grooved to specifications. Once difficult to paint, plywood is now available with



STRESSED-SKIN PANELS cover wide areas without extra supports. This carport roof is made of 4-by-20-foot plywood panels nailed and glued over and under 2-by-6-inch frame members.



CURVED RIBS made of six layers of quarter-inch plywood form the frame for a four-vault roof on a new private home in Houston, Tex.

a resin overlay that takes paint beautifully. With these and other improved prefinishing methods, plywood, once regarded as an ugly-duckling building material, can add good looks to its impressive list of advantages.—*Bert Goldrath*.



What is this?

Can you identify the objects pictured at left? Check your answer below.

ANSWER: They look like chestnuts, but they'll give you a big stomach-ache if you eat 'em. These concentrated-iron pellets make ideal feed for Bethlehem Steel blast furnaces. Through a new process, tacs—balls of about 65 percent iron, once a once-worthless low-grade ore, is separated and formed into nuts, but they'll give you a big stomach-ache if you eat 'em. These concentrated-iron pellets make ideal feed for Bethlehem Steel blast furnaces. Through a new process, tacs—

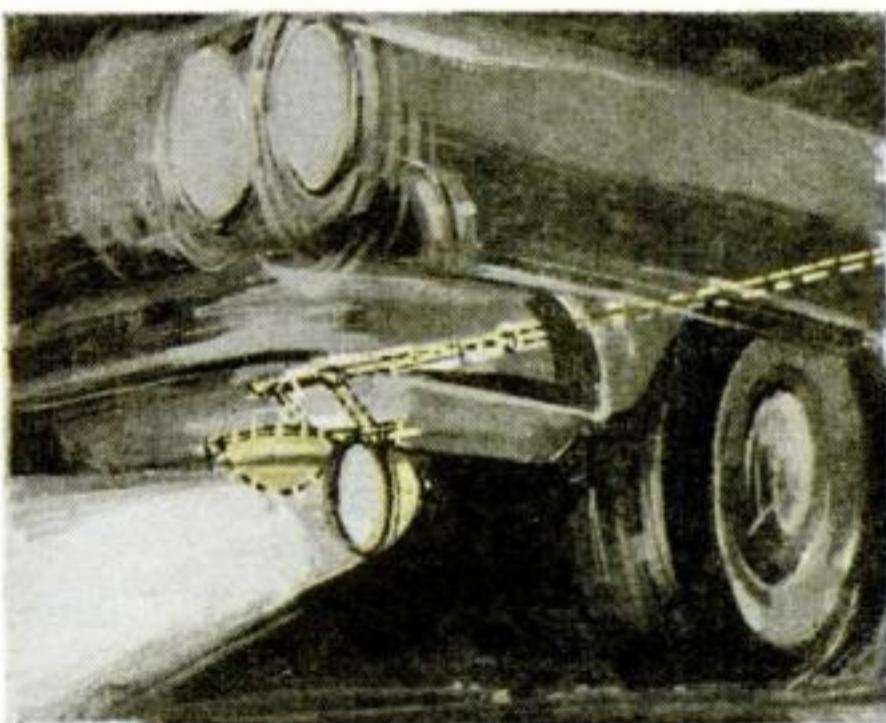
New Ideas from the Inventors



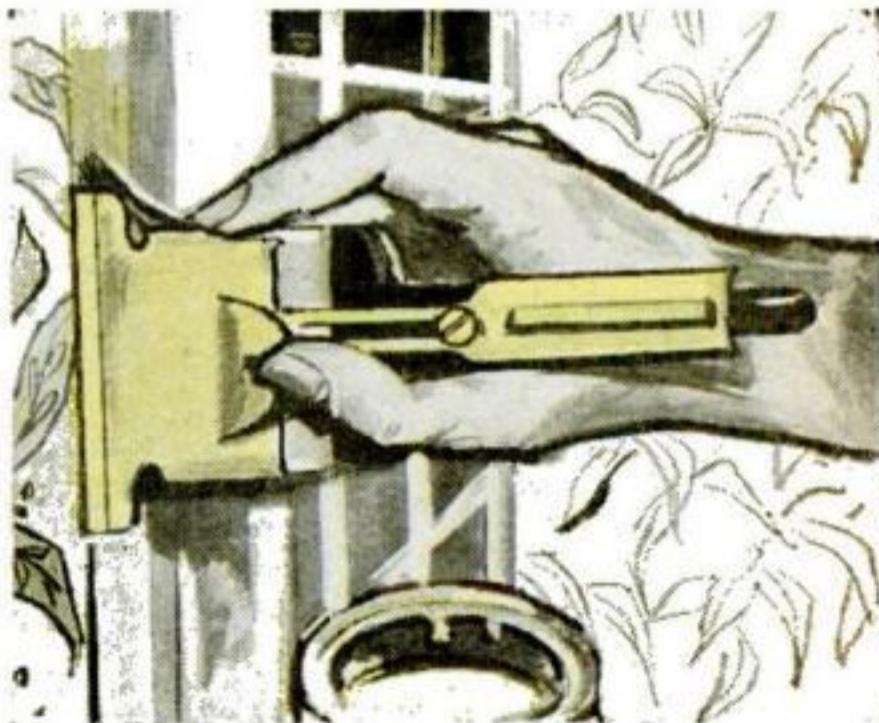
TV Sharpens Umpire's Eye. There'd be fewer squawks around a ball park if umpires used this recently patented monitor to help call balls and strikes. A camera at

left or right would check the ball's height; another, aimed downward, would show if it crossed the plate. An ump could adjust guides to match a batter's height.

Retractable Lights Cut Mist. Fog lamps light the road best if mounted low and forward on a car. To protect them from damage while parking or in traffic, one inventor would hinge them to drop down and out when needed, pull back into underslung housings when not in use.



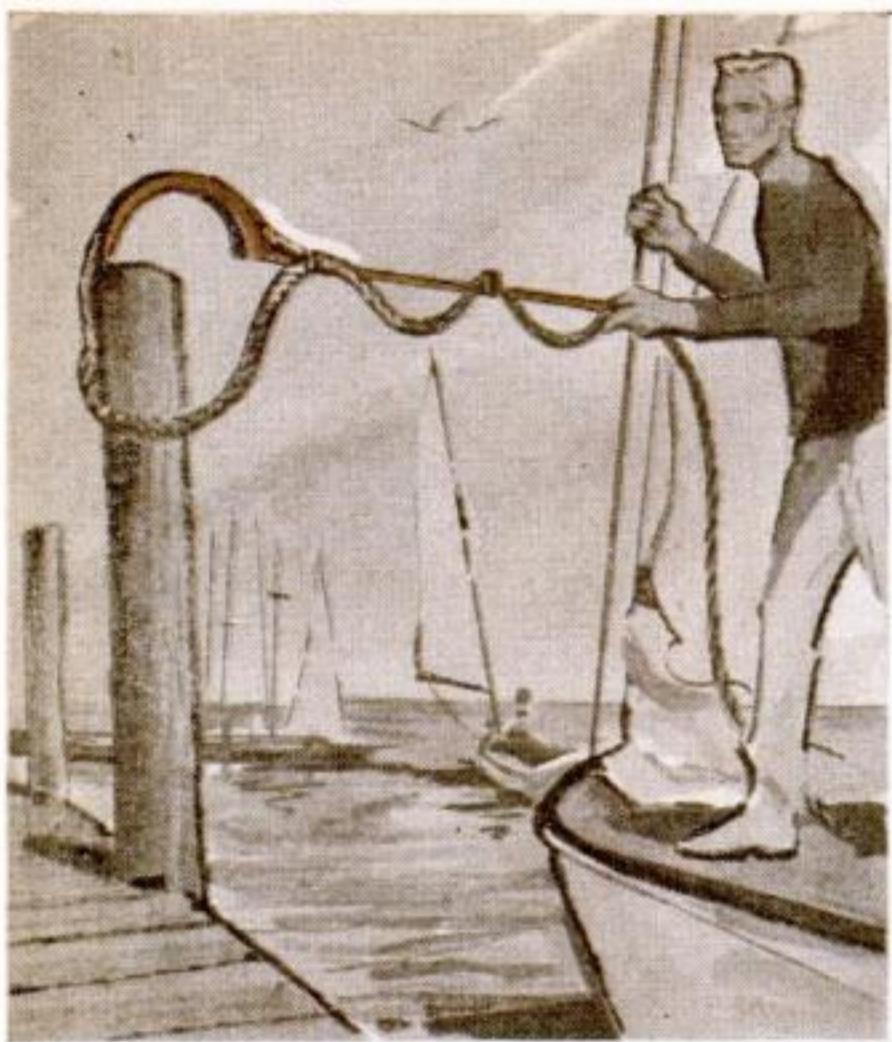
Brush Guard Prevents Smear. A one-way brush like this might make it easier to paint trim without smearing glass, wallpaper, or an adjacent wall. Clipped to your brush, the guard could be pulled back to permit free strokes or pushed down to mask the bristles on one side.



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More Inventors' Ideas



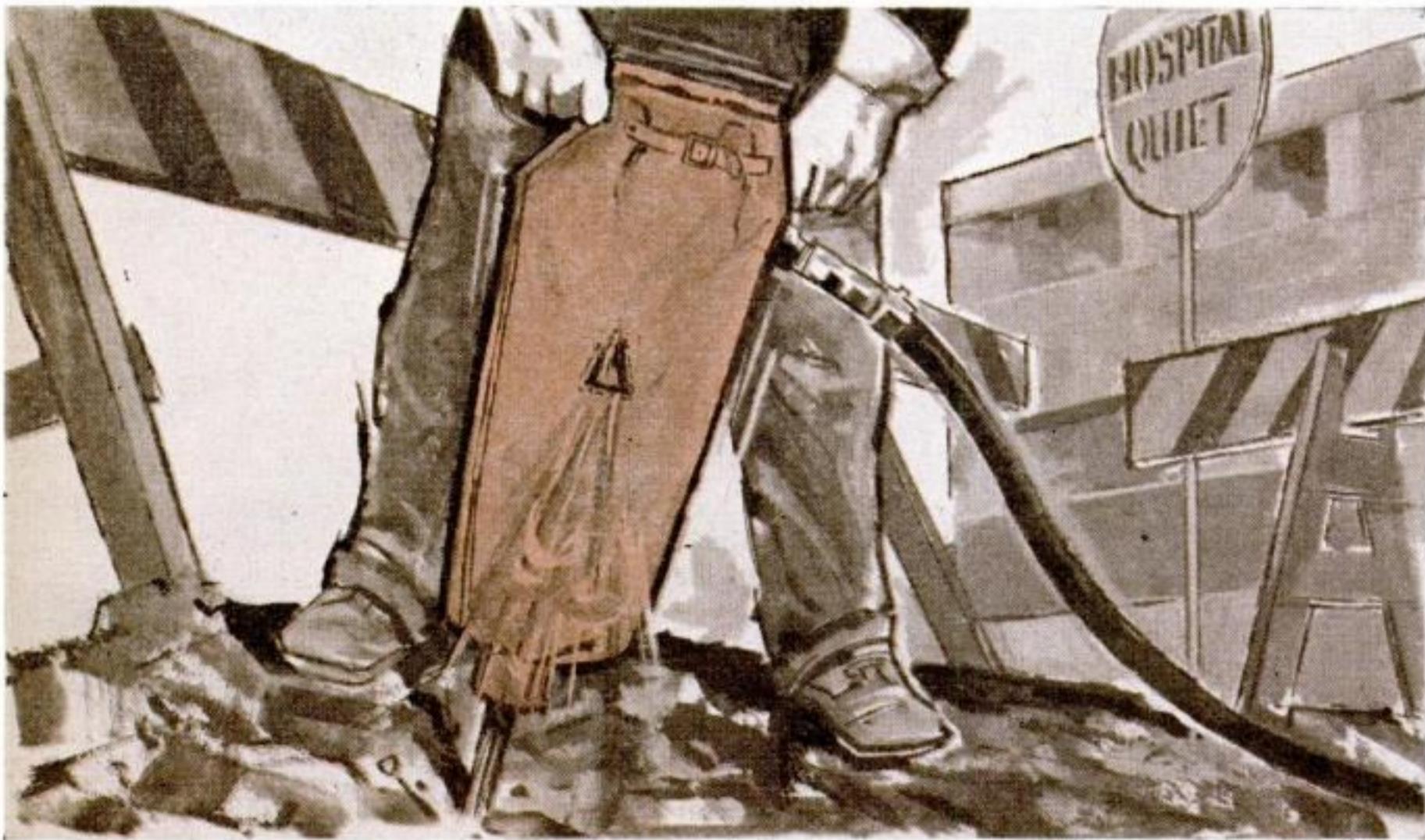
Hook "Lassoes" Mooring Post. This long-handled hook would let you tie up a boat from a distance, then pull into a dock quickly, easily, and safely. You'd fit the line into the hook's flange and channel, drop it over the post, then twist the hook to disengage the line.

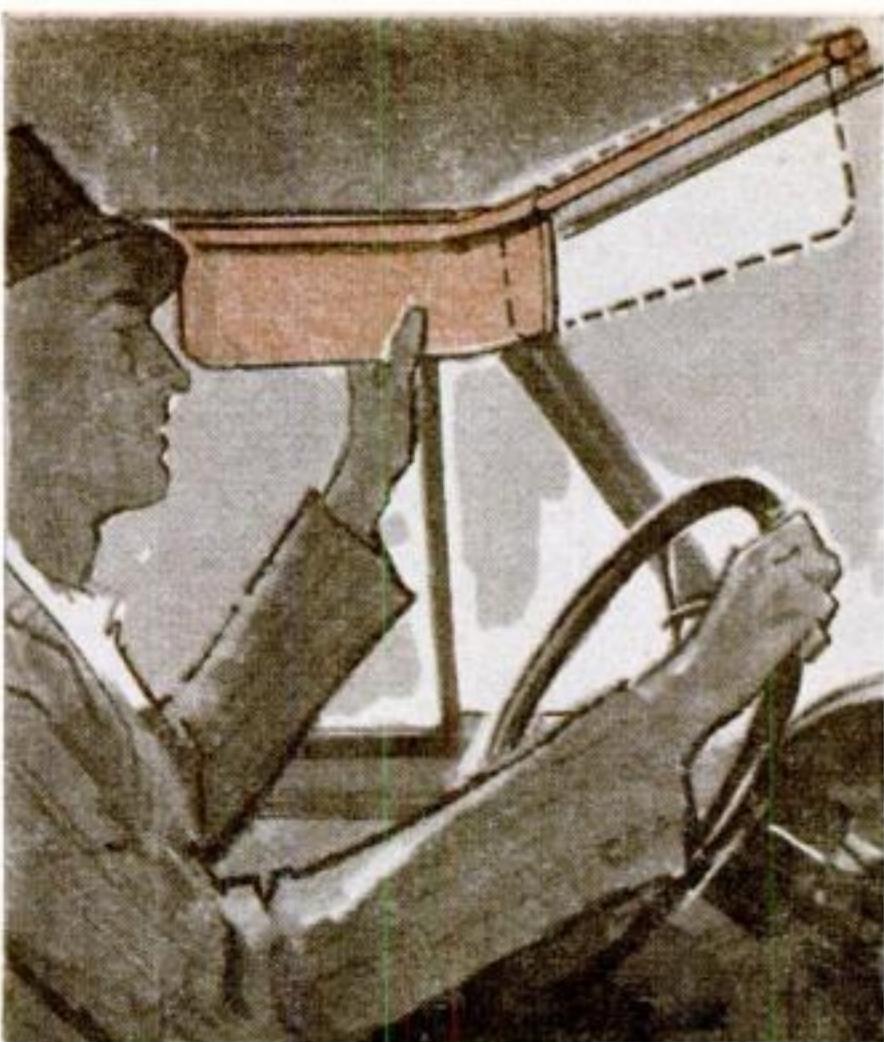


Board Speeds Burger Making. There'd be less work—and guesswork—in your barbecue preparations if you used a rail-guided rolling pin to spread hamburger meat to a uniform thickness. Knife edges in a let-down board of this chef's friend would cut the loaf into six equal patties.

Muffler Quiets Jackhammer. Pavement-repair work may jangle your nerves less if this inventor has his way. He'd enclose jackhammers in an inner jacket of sound-

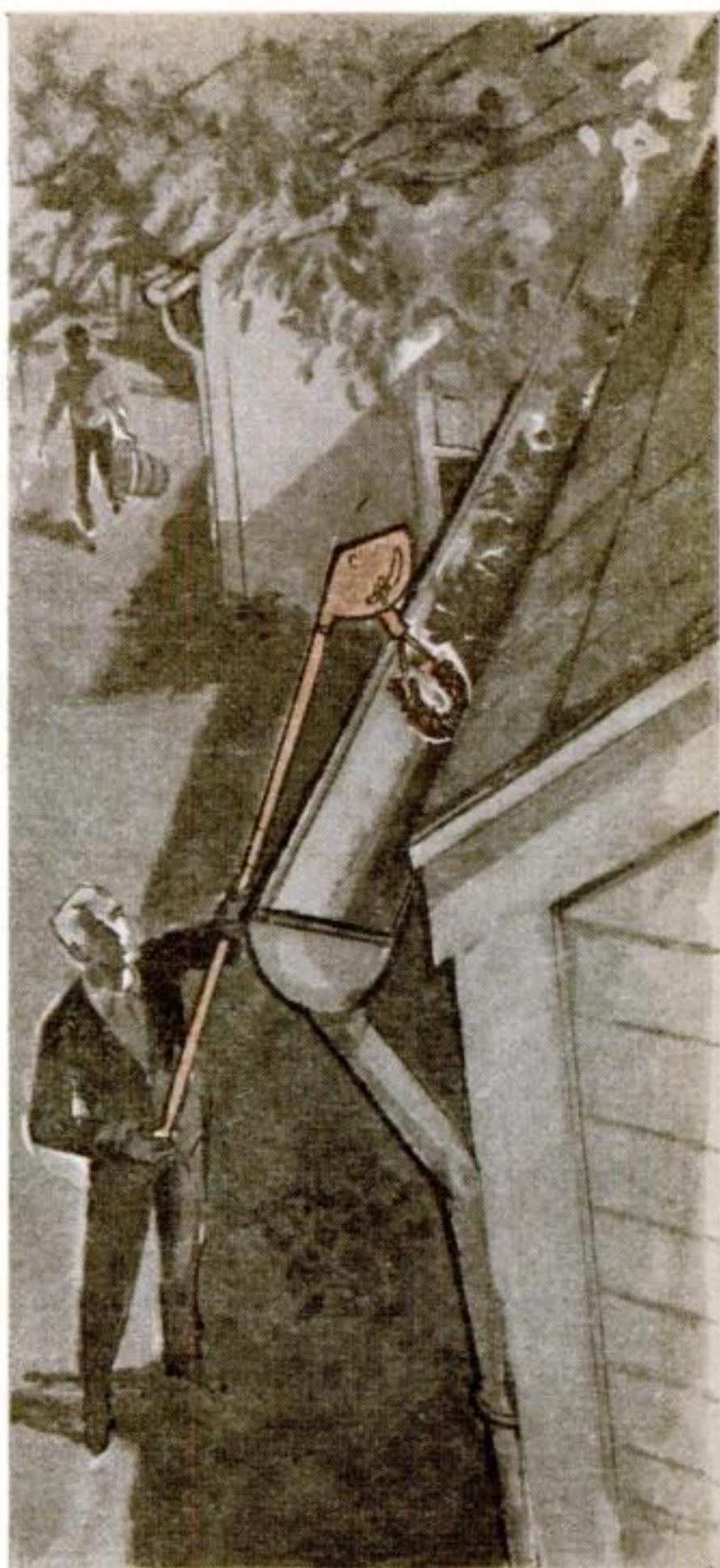
absorbing material, and an outer one of heavy canvas. The two-part sheath might muffle the tool's ear-assaulting air bursts and the clatter of its moving parts.





Visor Adjusts for Side Glare. Conventional sun visors can counter blinding rays coming directly from front or side, but are helpless when the angle of the sun is in between. This flexible visor, sliding on a bent rail, could be adjusted to block glare from any direction.

Rod Attachment Signals Bite. Ever wish you could lay your fishing rod down without missing a bite? You could, with a clip-on signal box containing flashlight batteries, bulb, buzzer, and a magnetic switch. You'd loop the line over a hook that acted as a switch trigger, so even a slight tug on the line would let you know that you'd hooked a fish.



Angled Brush Sweeps Gutters. By adjusting this long-handled brush so it reached down into a house gutter, you could sweep out spout-clogging leaves almost as fast as you could walk. Working from the ground, you'd skip both the hazards of ladder climbing and the nuisance of moving a ladder every few feet.

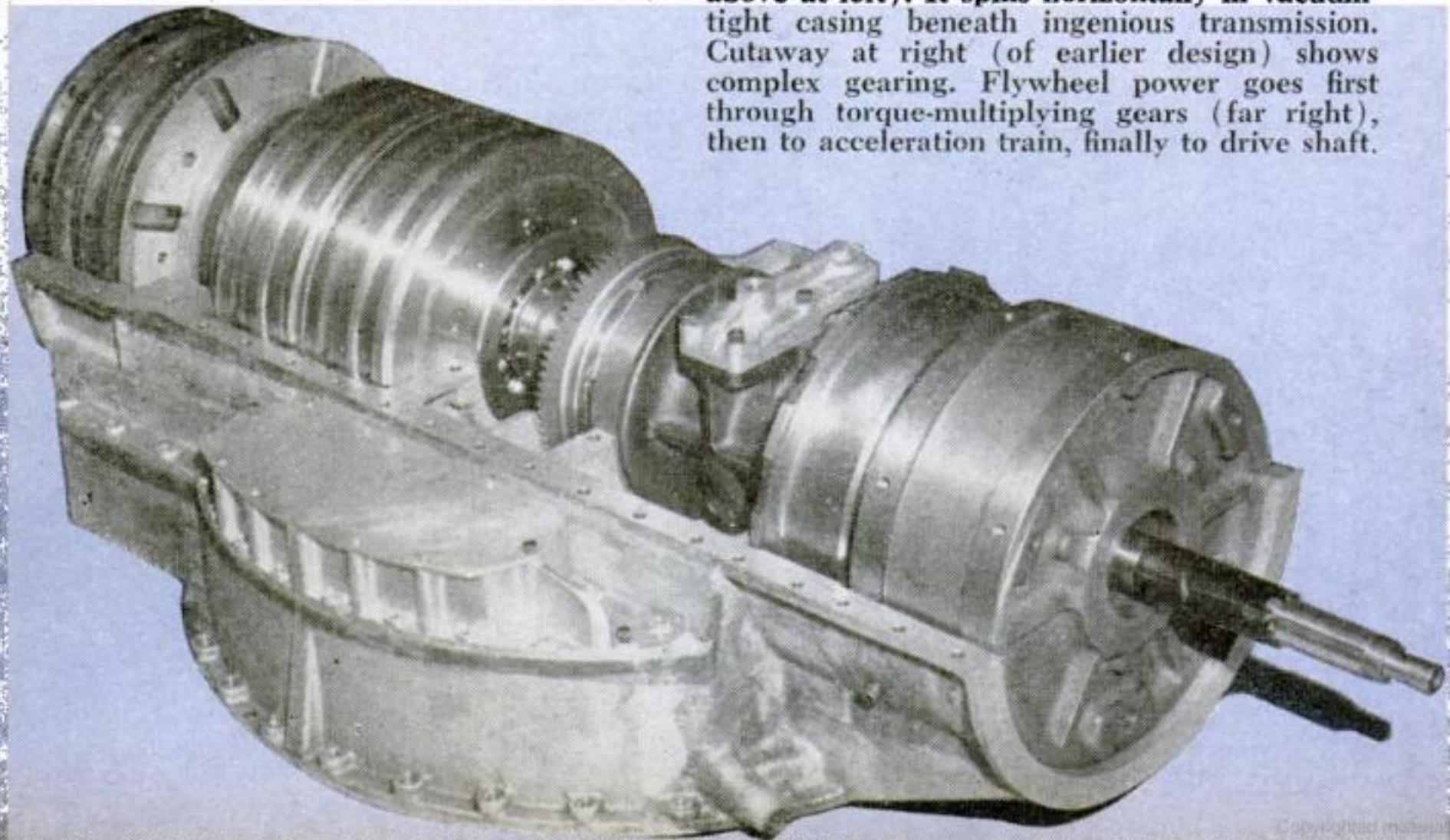
The following patents have been issued on these inventions:
TV umpire—No. 2,943,141 to L. Knight, Levittown, N. Y.;
Fog lights—No. 2,713,113 to W. Snook, Ottumwa, Iowa;
Brush guard—No. 2,820,237 to J. Maslaney, Cadillac, Mich.;
Hook—No. 2,811,127 to M. Palsson, Wenatchee, Wash.;
Meat roller—No. 2,827,658 to H. Hoig, McKean, and E. Taft, Erie, Pa.;
Muffler—No. 2,949,975 to W. Plummer, N. Hollywood, Calif.;
Visor—No. 2,932,539 to W. Galbraith, Albany, Ore.;
Rod signal—No. 2,814,900 to R. Frazier, Kansas City, Mo.;
Gutter brush—No. 2,817,867 to H. Bugbird, Summit, N. J.

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D. C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

Fifth Wheel Runs

Perpetual motion? Almost. This flywheel stores braking energy, releases it for acceleration

By David Scott



WHEN the driver of the new bus shown here and on the cover hits the brakes, the engine revs up. That may startle the passengers, but it saves fuel. For this far-out machine runs partly on brake power.

It's a weird and wonderful Rube Goldberg, combining a big flywheel (200 pounds, 15,000 r.p.m.), half a dozen planetary gearsets, and a diesel engine. The flywheel is a checking account for energy. When you want to accelerate the bus, you cash some flywheel energy to help speed up the bus wheels—the flywheel helps drive the wheels. When you want to stop the bus, you make the bus wheels drive the flywheel. This slows down the bus wheels and speeds up the flywheel, depositing energy in the bank for the next acceleration expenditure. You need the diesel because the system doesn't quite achieve perpetual motion, although it comes close.

The flywheel is so delicately balanced—whirls so easily—that you can park the bus overnight and still have spin left to start the diesel with it next morning. (After lengthy lay-ups for repairs,

GYREACTA POWER SYSTEM has two-foot, mirror-finished flywheel (being calipered by technician above at left). It spins horizontally in vacuum-tight casing beneath ingenious transmission. Cutaway at right (of earlier design) shows complex gearing. Flywheel power goes first through torque-multiplying gears (far right), then to acceleration train, finally to drive shaft.

Bus... Stops It, Too

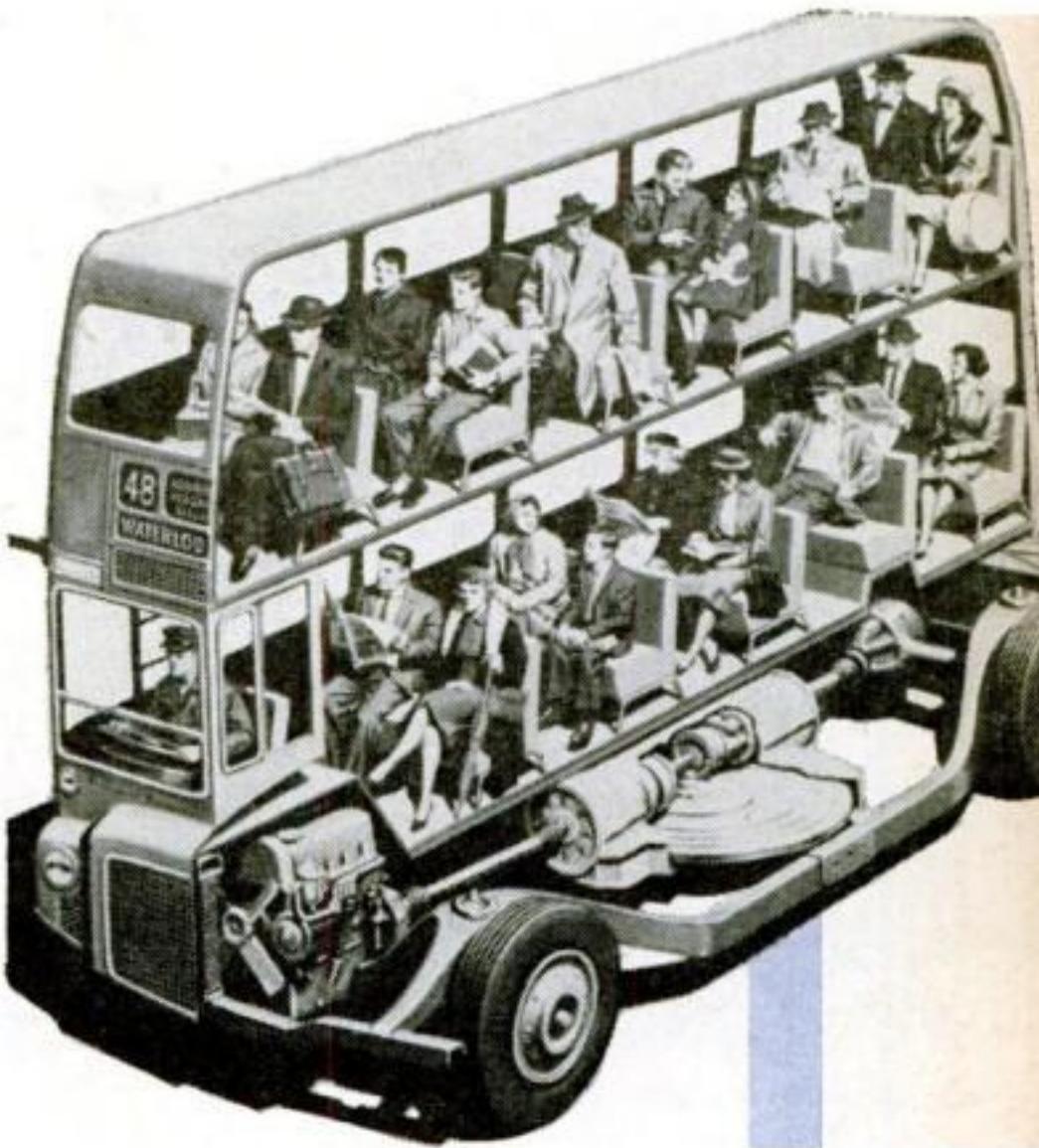
the diesel would have to be cranked with an electric motor.)

No crackpot scheme, the Gyreacta project is financed by the British Government. Three experimental flywheel power trains have been built and one is now test-driving a bare chassis around a parking yard. Another—camouflaged as a standard vehicle of the Midland Red fleet—will soon be carrying passengers on a regular run through Birmingham, England.

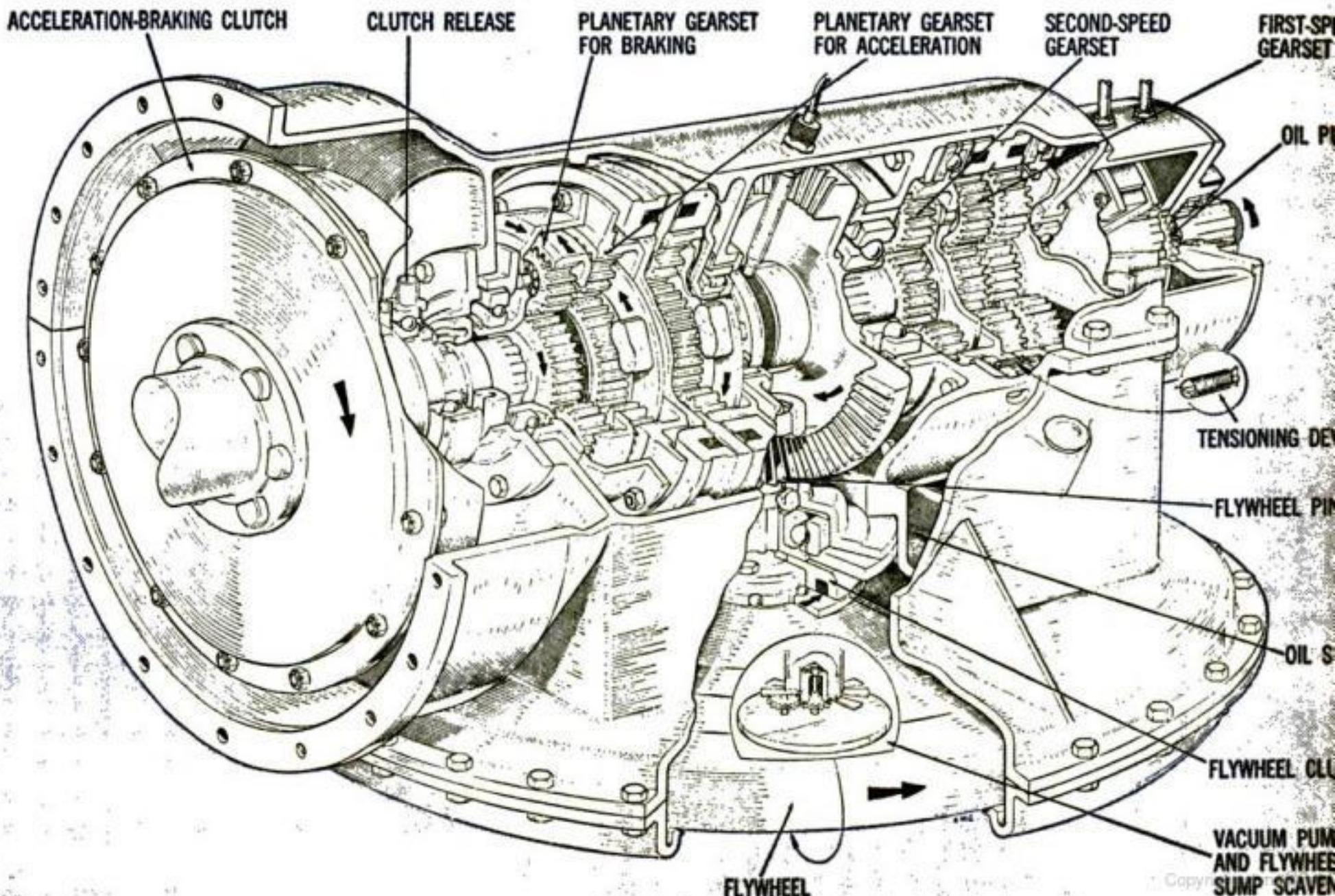
The advantage: money. The idea of storing braking energy—instead of wasting it as heat—and then using it to drive the vehicle was thought up by balding, 52-year-old British inventor Robert Clerk. The big advantage is money. Clerk figures his system could cut London Transport's huge fuel bill by 30 percent. Not only that, but by taking part of the load off both engine and brakes, it permits the use of a smaller engine and lighter brakes. By improving pickup, it speeds stop-and-go running.

The Gyreacta makes sense only in stop-and-go operation. It's ideal for

CONTINUED



STANDARD DOUBLE-DECKER of Midland Red fleet will hide the Gyreacta transmission under floor for passenger-service trials on the streets of Birmingham, England. Flywheel furnishes most of power needed for acceleration, cuts out for constant-speed running, which diesel handles.



city buses, which pull up every few blocks. It might also pay off for delivery trucks making frequent stops and starts, such as milk trucks.

Using flywheels to provide power is an old idea. They drive small toy cars. A naval torpedo that was standard here and abroad in the late 1800s hit 24 knots on flywheel power. Airplane-engine starters and an airplane-launching catapult were based on them. Swiss buses built by Oerlikon [PS, Mar. '51] run entirely on flywheels.

In all these older machines, however, the flywheels only relayed driving power that first had to be fed in from some outside source. Oerlikon's Gyrobus, for example, plugs into an electric outlet at every stop so that an electric motor can spin up the flywheel. None reused energy wasted by the vehicle itself, the way Clerk's Gyreacta does.

Planetary coupling. The Gyreacta uses diesel and flywheel as two separate engines, coupling them together through a very ingenious planetary—really two gear trains that share some parts (see drawings). Power always enters this planetary set through the sun gears (from diesel) and ring gears (from flywheel or drive shaft). Power always leaves through the planet carriers (to drive shaft or flywheel).

For acceleration, the flywheel-driven ring gear adds its torque to that of the diesel-driven sun. The combined torque speeds up the planet carrier, which turns the drive shaft. This takes energy out of the flywheel, slowing it down. A loss of 1,000 r.p.m. during a 15-second acceleration is the equivalent of 120 hp. That's more than the diesel can put out.

For braking, a clutch switches the drive shaft to the ring gear, which again speeds up the planet carrier. But that is now connected to the flywheel. So the flywheel speeds up. It gains about 1,000 revs every time the bus is braked from 30 to 10 m.p.h. By absorbing energy from the bus wheels, the flywheel re-

tards their motion just as brake shoes do.

Oddly, the flywheel works better as a brake if at the same time the diesel is revved (the brake pedal is linked to the throttle). Revving the diesel speeds up the sun gear and therefore the planets—in effect changing the gear ratio between ring gear (drive shaft) and planet carrier (flywheel). The changed gear ratio makes the flywheel absorb energy from the wheels at a faster rate.

This power-assisted inertia braking slows the bus down to 10 m.p.h. At that speed the planetary shifts to neutral and the wheel brakes take over. (One reason: Passengers might be unhinged if the bus stopped dead on a rising engine note.)

The Gyreacta planetary coupling acts as a switch to send energy one way or the other. It does not

multiply torque. For that there is a separate four-speed gearbox (also planetary) operated by electromagnetic clutches. This torque converter goes between the flywheel and the Gyreacta coupler. It cuts out completely for constant-speed running. Then the diesel locks up in direct drive to the wheels, and the flywheel just spins without doing any work.

Drawing from the diesel. Since the Gyreacta is not quite a perpetual-motion machine, the bus sometimes withdraws more energy for acceleration from its flywheel bank than it deposits during braking. The diesel has to make up the overdraft. A red light on the dashboard warns when flywheel revs drop below 12,000. At the next stop, the driver pushes a button to lock in the accelerating gear train. It winds up the flywheel 100 r.p.m. every second, and cuts out automatically when maximum r.p.m. is reached.

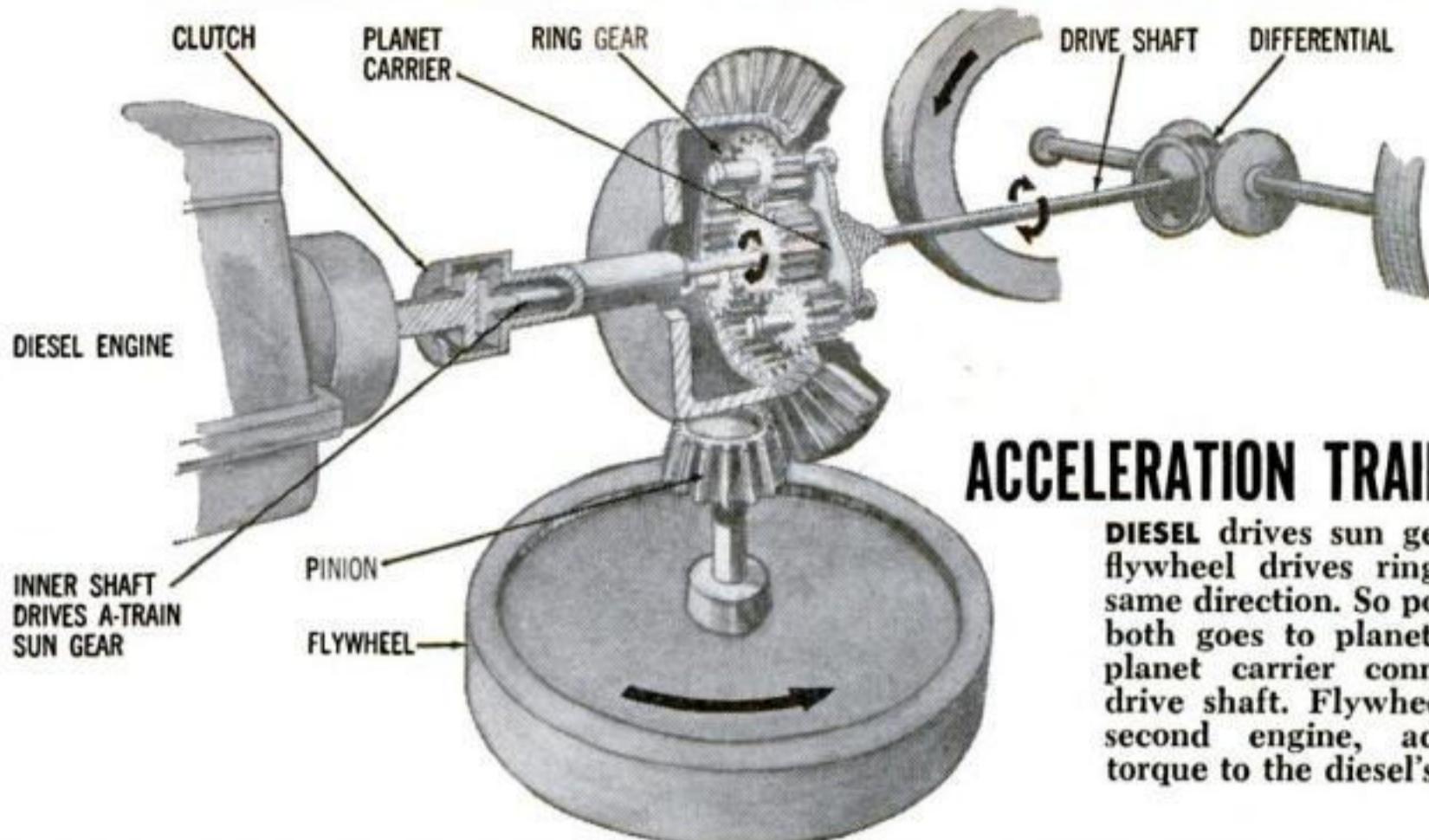
Running a flywheel at such speeds poses tricky problems. The rim of the two-foot-diameter disk is moving faster than 1,000 m.p.h.—faster than sound. To keep wind resistance down, it has to spin in a vacuum.

So there's a small gear-type pump fastened directly to the flywheel. It ex-



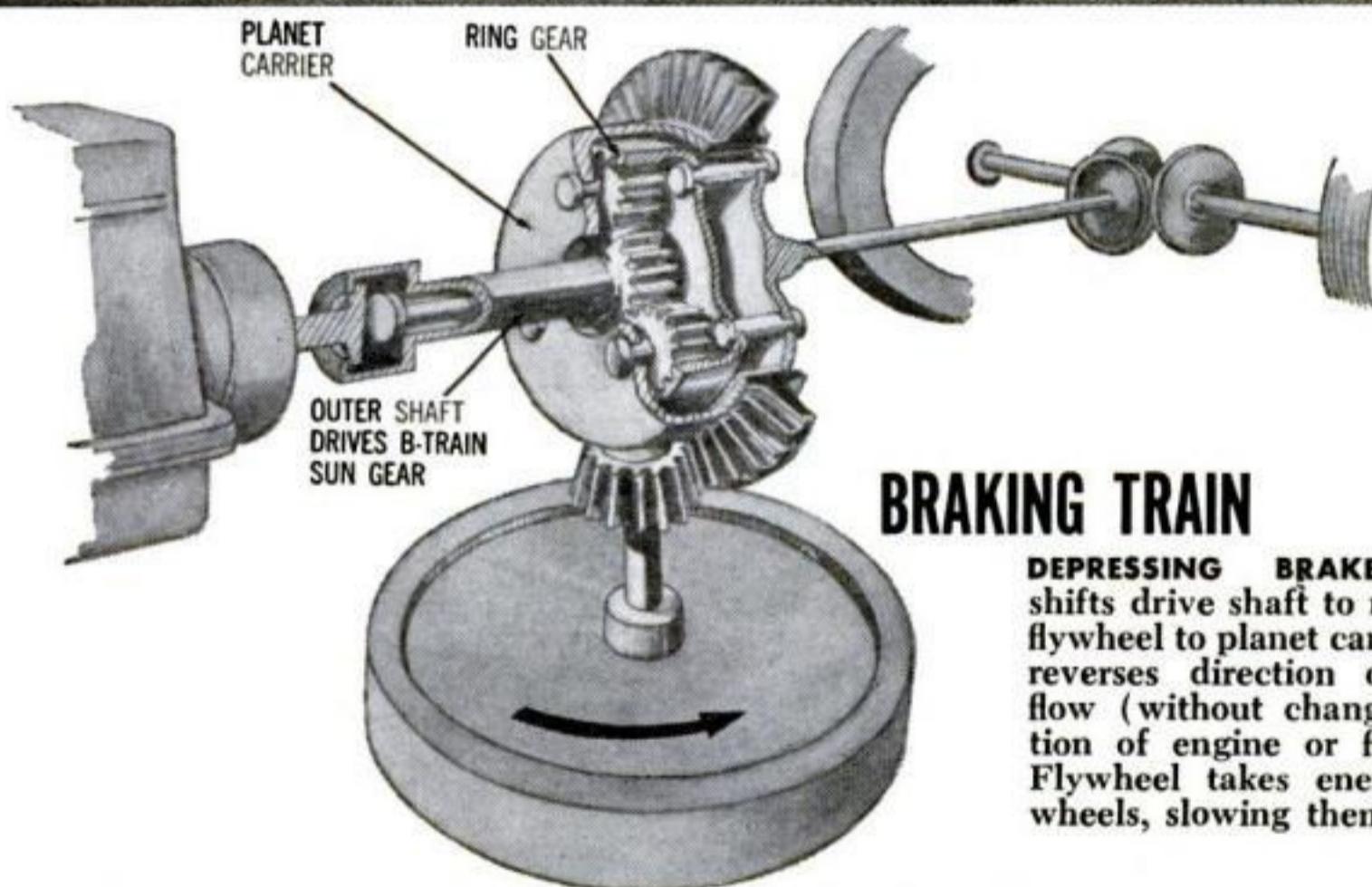
GYREACTA CREATOR is Robert Clerk, British pro who has been inventing since he built his own biplane at 16. Among his recent developments: a machine to make gears by cold-rolling.

Trick planetaries make flywheel speed up or slow down wheels



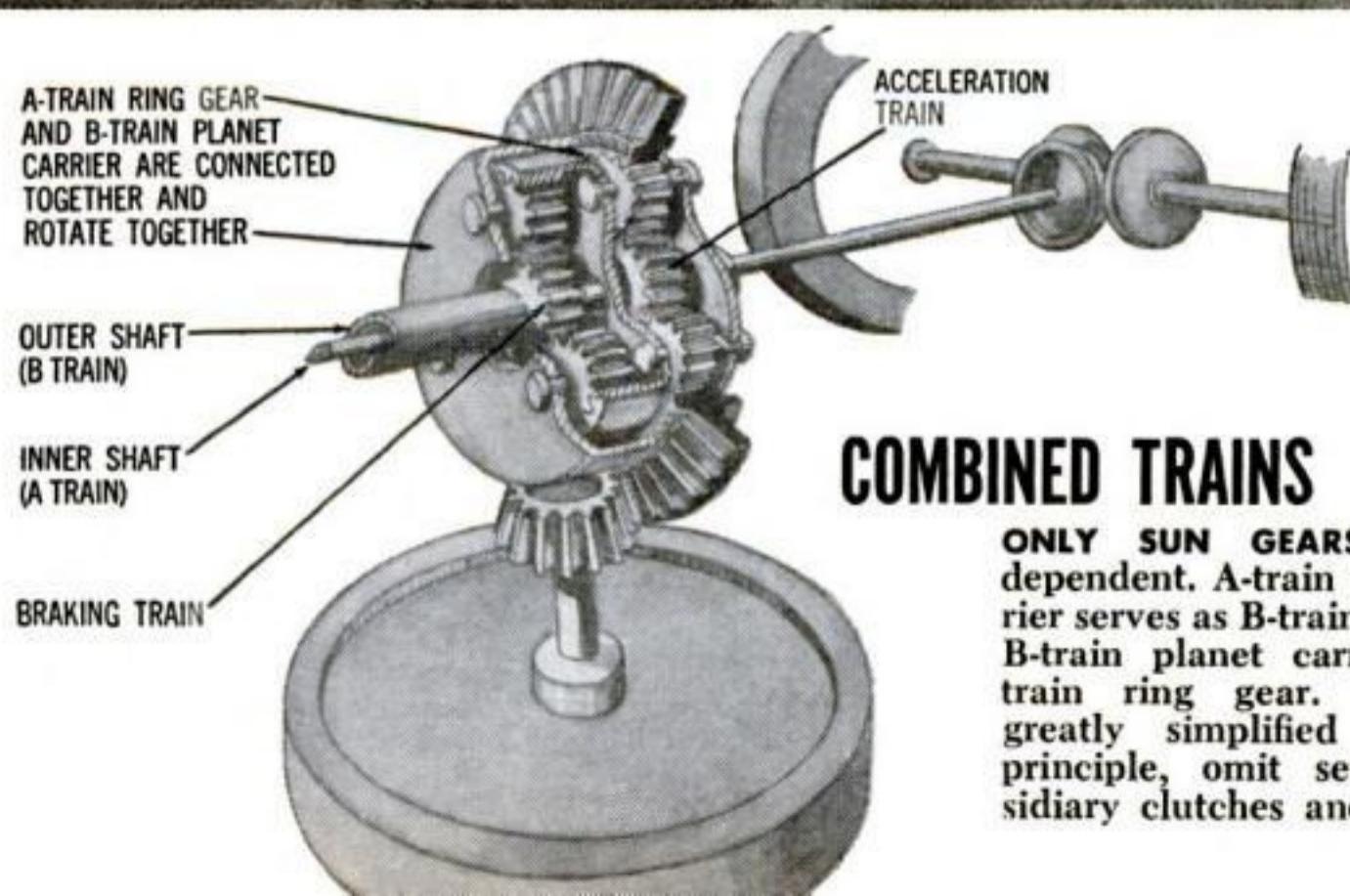
ACCELERATION TRAIN

DIESEL drives sun gear, while flywheel drives ring gear in same direction. So power from both goes to planets to turn planet carrier connected to drive shaft. Flywheel acts as second engine, adding its torque to the diesel's.



BRAKING TRAIN

DEPRESSING BRAKE PEDAL shifts drive shaft to ring gear, flywheel to planet carrier. This reverses direction of power flow (without changing rotation of engine or flywheel). Flywheel takes energy from wheels, slowing them.



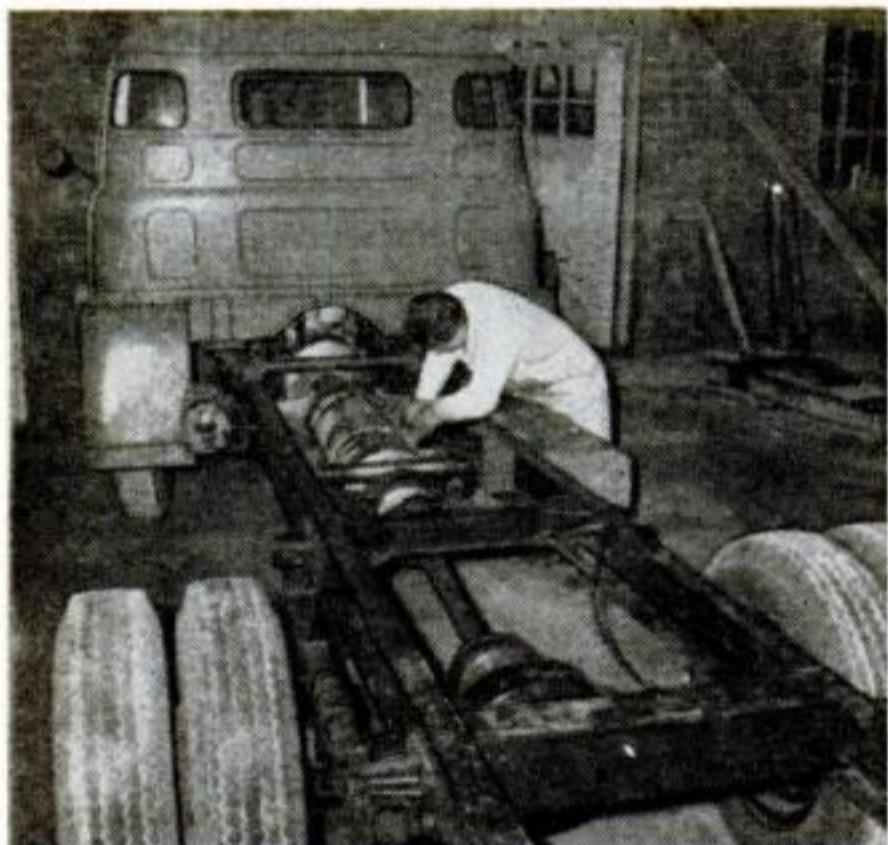
COMBINED TRAINS

ONLY SUN GEARS are independent. A-train planet carrier serves as B-train ring gear, B-train planet carrier as A-train ring gear. Drawings, greatly simplified to show principle, omit several subsidiary clutches and gearsets.

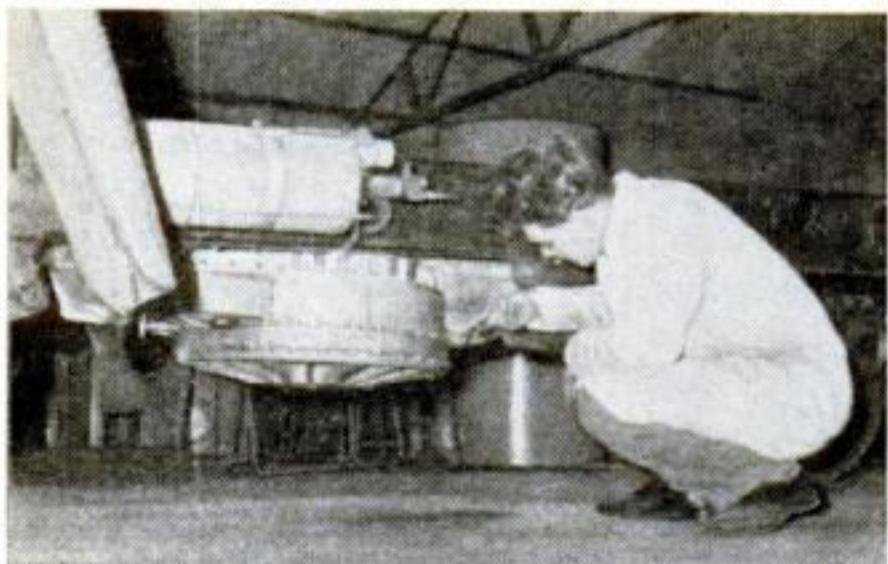
Where it stands today: Gyreacta starts practical testing



SIMPLIFIED CONTROLS in cab of first vehicle to use the system are tried out by inventor Clerk.



GYREACTA fits amidships in experimental rig—the bare chassis of a British-built Dodge truck.



FLYWHEEL hangs underneath transmission, inside vacuum case being tightened by a mechanic.

hausts air and also scavenges oil that collects in the bottom of the housing. Yet it can't hold a very good vacuum, despite near-perfect sealing. The reason: Air comes in with the oil, not as bubbles but absorbed in the fluid, making up eight percent of its volume. Improvement of the pump and its exhaust channels, to cut air friction losses, is one of the main problems facing inventor Clerk.

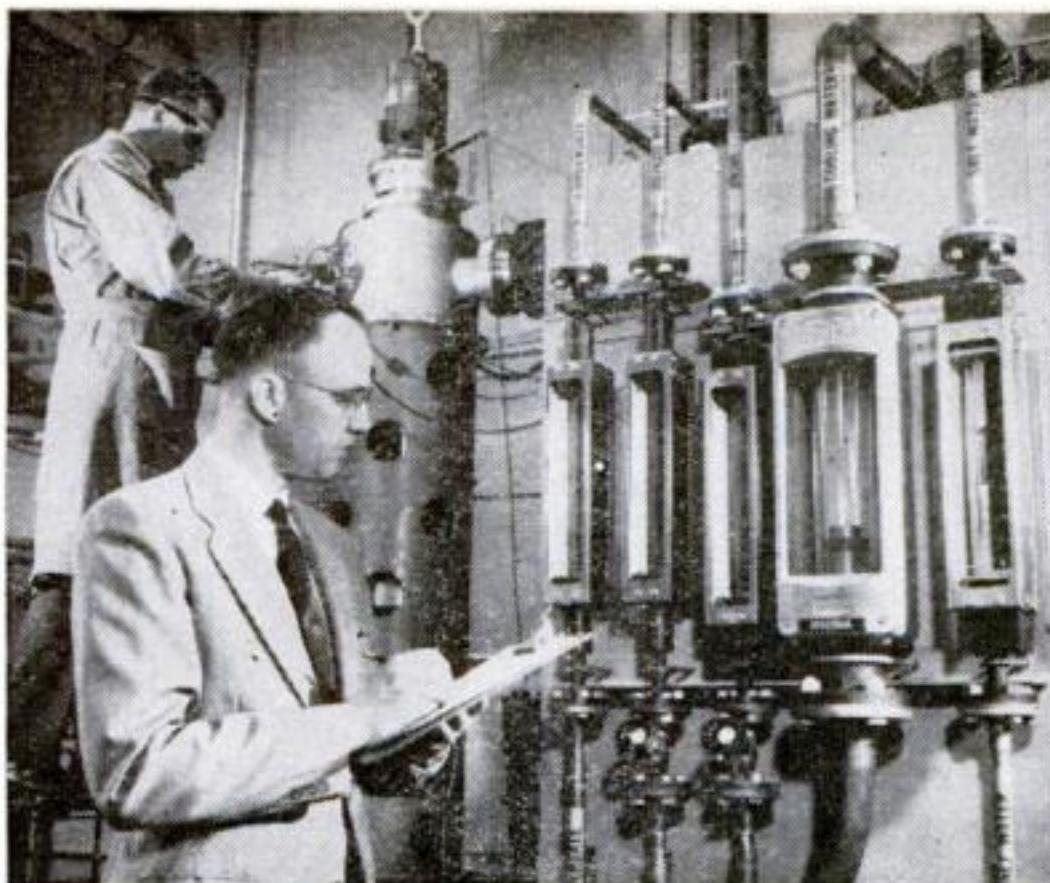
Are there other snags? Clerk laughs off fears that the flywheel's gyroscopic effect might make the bus yaw off course if the wheels left the road on a bump. The flywheel isn't big enough, he says, to cause more than a slight pitch or roll. As for the flywheel bursting or breaking loose in a crash—the bus and transmission housing would have to disintegrate before that could happen.

Clerk should know, for he has racked up successes in a variety of fields that range from chocolate-making machinery to sliding windows for trains and a system for cold-rolling gears.

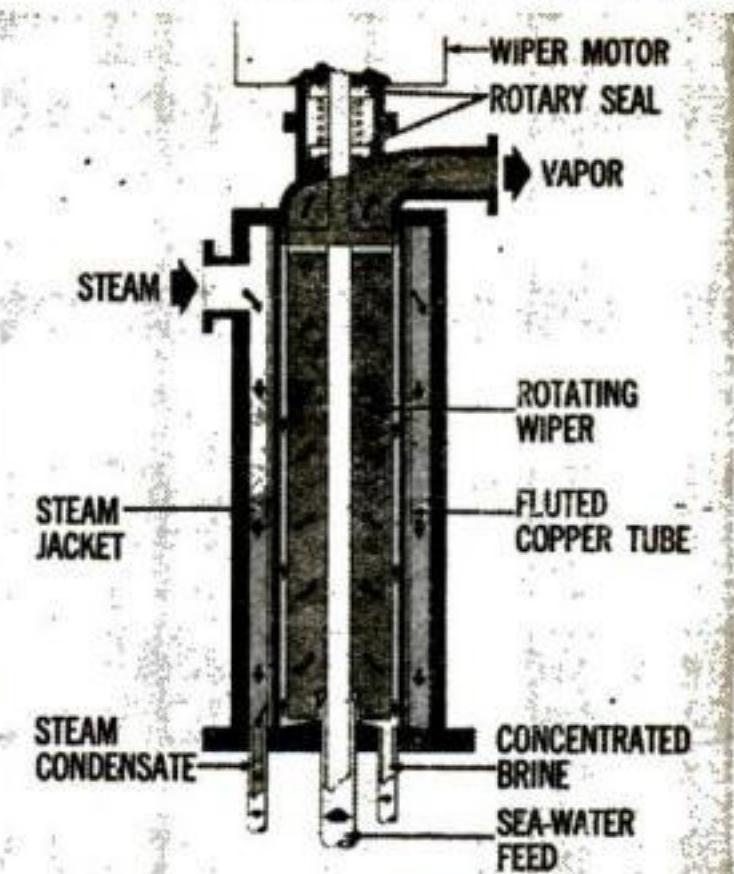
The real test that the Gyreacta faces is practicality. If current trials work out as Clerk hopes, the world will have a new form of city transportation—unusually smooth and remarkably economical.



NEXT STEP: A REAL BUS. No. 168 above is typical of vehicles that may use the Gyreacta unit.



LABORATORY EVAPORATOR is the large tube second from right. It is glass instead of metal so observations can be made. Smaller tubes on either side are for comparison readings.



HOW IT WORKS is shown by diagram above. Sea water enters through hollow axis of rotating wiper blades, is rubbed in a thin film on inside wall of the tube, and vaporized there.

"Windshield wipers" purify salt water

A new system to convert sea water to fresh water uses wiper blades to spread a thin film on the inner wall of a copper tube inside a steam jacket. There fresh water is vaporized and rises to an outlet at top. The concentrated brine flows out

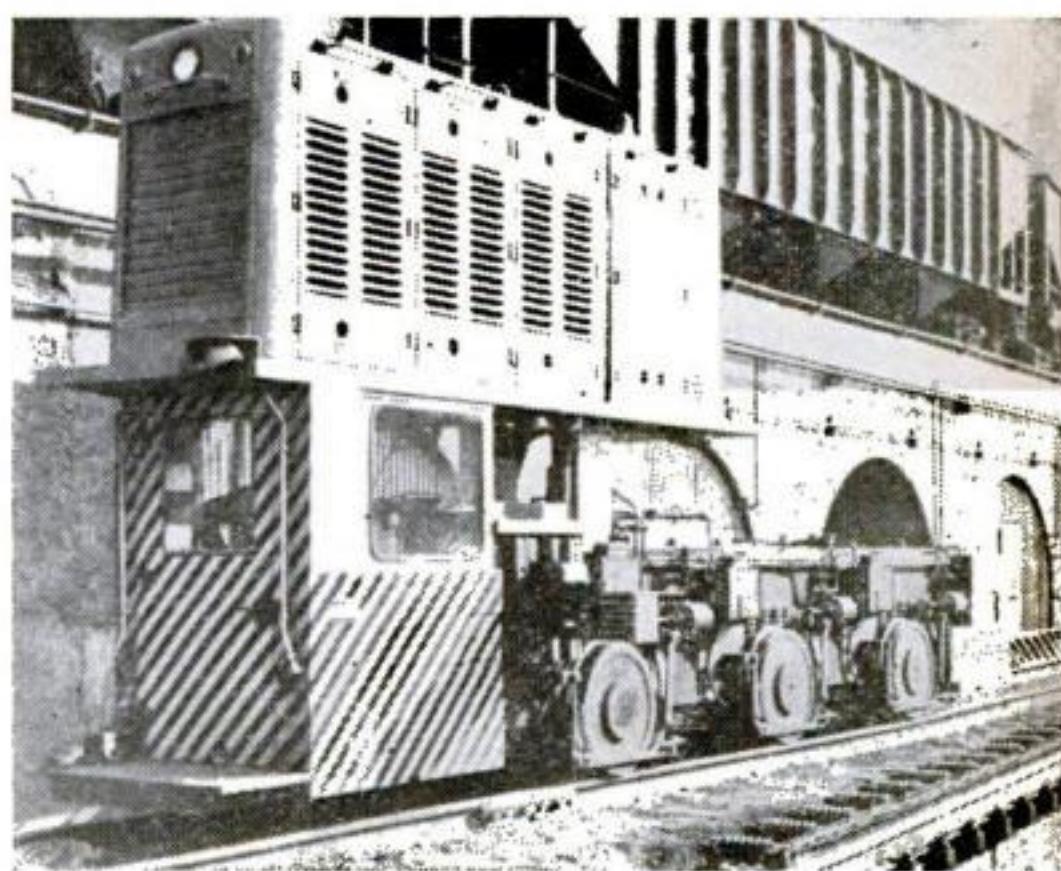
at bottom. GE, which developed the system for the Navy and Interior Department, calls it the most economical distillation process yet devised, says it converts 40 percent of the input and takes up little space.



Word-shooting gun

Messages spoken into this "ray gun" are converted electronically into infrared radiation and transmitted by narrow beam to a similar instrument as far as three miles away. The receiving gun reconverts them to sound. The talk can't be intercepted or jammed by eavesdroppers.

Minneapolis-Honeywell developed the MAXSECOM (Maximum Security Communications) for military, police, civil-defense, and industrial uses requiring secrecy. Similar smaller units have a range of 500 yards [PS, Jan.]; larger systems can send over a distance of 20 miles.



Engine-over-cab locomotive

The diesel-electric power plant of this 90-ton locomotive rides on top of the engineer's cab instead of over the trucks. The engine was built by General Electric to push loaded coal cars at a steel-company coke plant in East Chicago, Ill. The unorthodox arrangement gives the operator perfect visibility and speeds uncoupling of cars.

How a Coffee

ANY cellar mechanic could cobble up a gadget to spurt hot water through instant coffee powder. Early coin machines did just that. Today, to satisfy the taste for real brew, coffee machines have grown nearly as complicated as cars.

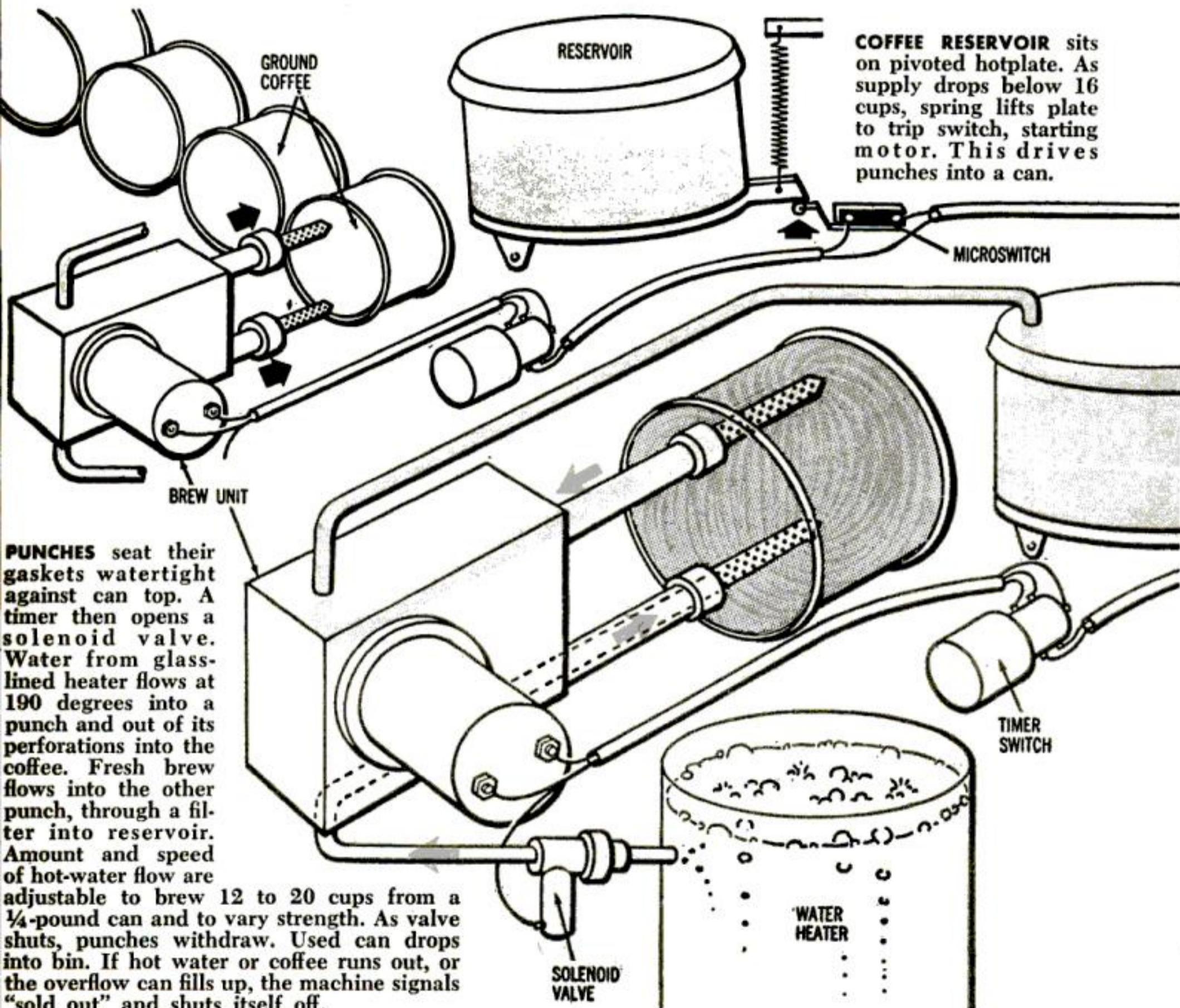
Some still make java from powdered coffee or liquid concentrate. One new vendor of this kind features downdraft mixing that's supposed to waft coffee aroma to the customer. Instant-type machines are less complex than the fresh-brew kind, which make coffee from the ground bean as you might at home.

Some brew a cup at a time, either from bulk coffee suitably metered, or

from a tape with the ground bean sealed into pockets. A gadget pierces one pocket, shoots hot water through it. Other vendors brew batches from small cans of ground bean, make a reserve of fresh coffee and keep it hot.

The newest machines give the buyer his choice of coffee black, with cream, with or without sugar, or with double sugar. Many sell hot tea, chocolate, or soup in addition to coffee.

The batch-brew machine shown here refrigerates the cream (some vendors use powdered), keeps sugar from clumping with a blower that scavenges steam and vapor, and rinses the last vestige of

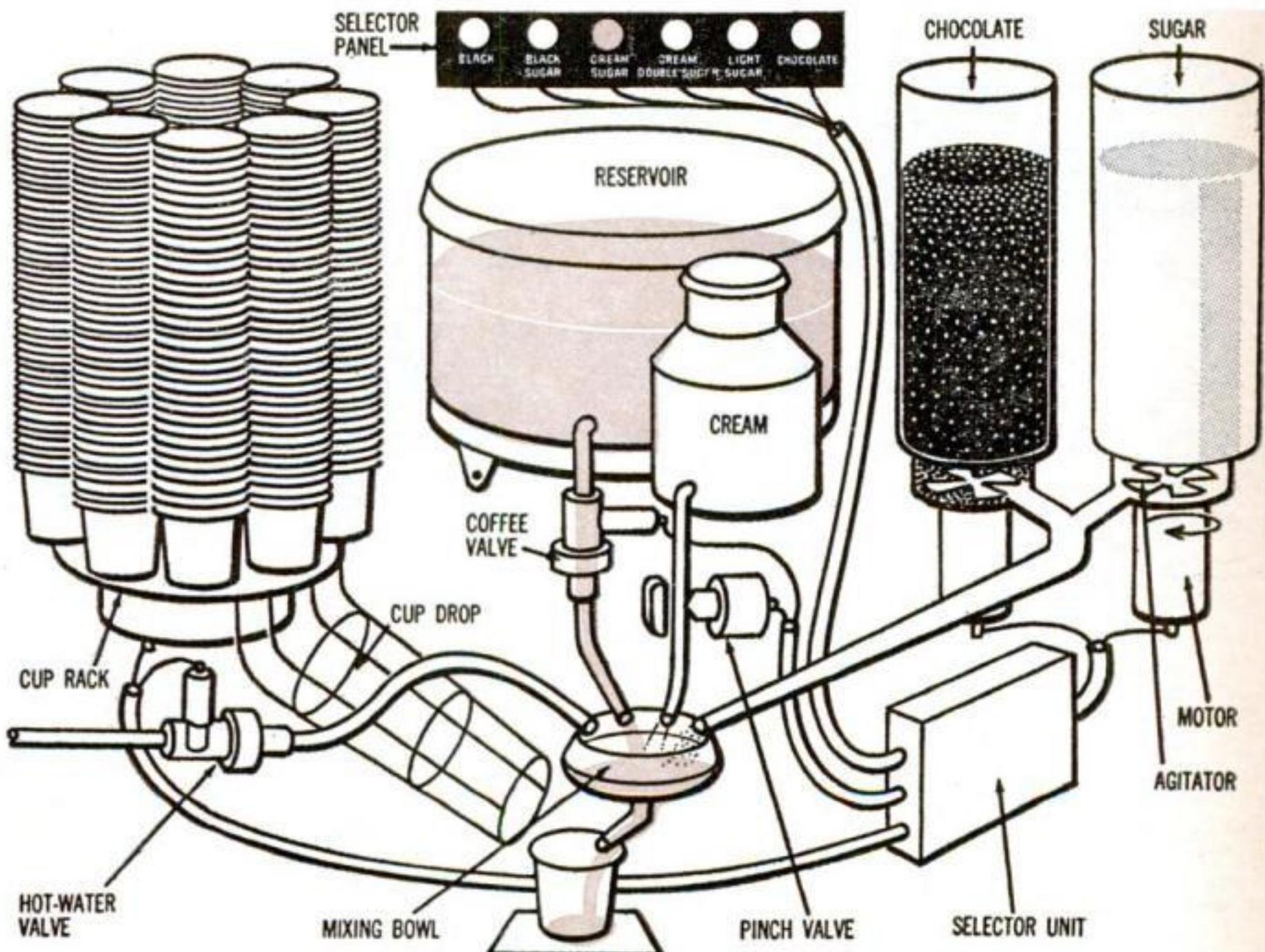
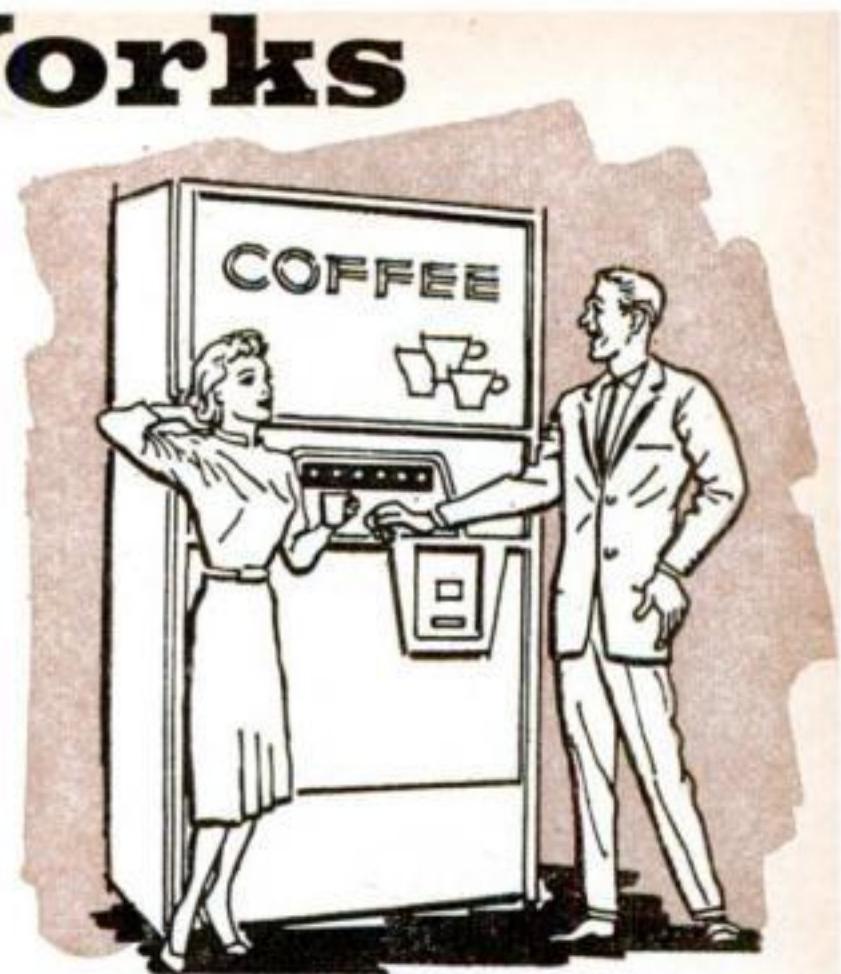


PUNCHES seat their gaskets watertight against can top. A timer then opens a solenoid valve. Water from glass-lined heater flows at 190 degrees into a punch and out of its perforations into the coffee. Fresh brew flows into the other punch, through a filter into reservoir. Amount and speed of hot-water flow are adjustable to brew 12 to 20 cups from a $\frac{1}{4}$ -pound can and to vary strength. As valve shuts, punches withdraw. Used can drops into bin. If hot water or coffee runs out, or the overflow can fills up, the machine signals "sold out" and shuts itself off.

Machine Works

cream and sugar out so that the next fellow who wants it black and bitter will get it that way. It knows when to brew a fresh batch, dumps remaining coffee when the customers have left for the day, starts a new brew for the morning trade, and shuts itself off if sold out and on weekends—including the four-day holiday kind.

It's done with timers, rotary and snap switches, small motors, cams, and solenoid valves. Small wonder the machines cost money. The instant type start at about \$500. Fresh-brew vendors may weigh 800 pounds and cost \$1,500. The one shown is made by The Vendo Company.



COIN MECHANISM evaluates dropped cash, rejects damaged coins and slugs. If accepted, coin is credited by a switch that closes selector circuits. Holding button for desired coffee (cream and double sugar, for example) turns a solenoid-operated rotary switch to line up circuits for needed ingredients. A motor turns cup rack, dropping cup. Then cams on the rack shaft trip switches for intervals determined by the shapes and settings of the cams.

COFFEE FLOWS as a switch opens solenoid valve. Another solenoid unpinches cream spout, while sugar motor starts metering one measure. Ingredients swirl into mixing bowl and blend. One cam on cup-rack shaft restarts the sugar motor after it would normally shut off, metering a second portion. As cup rack completes a full turn, all cam switches return to normal. For a chocolate drink, hot water and powder are poured into the mixing bowl instead.

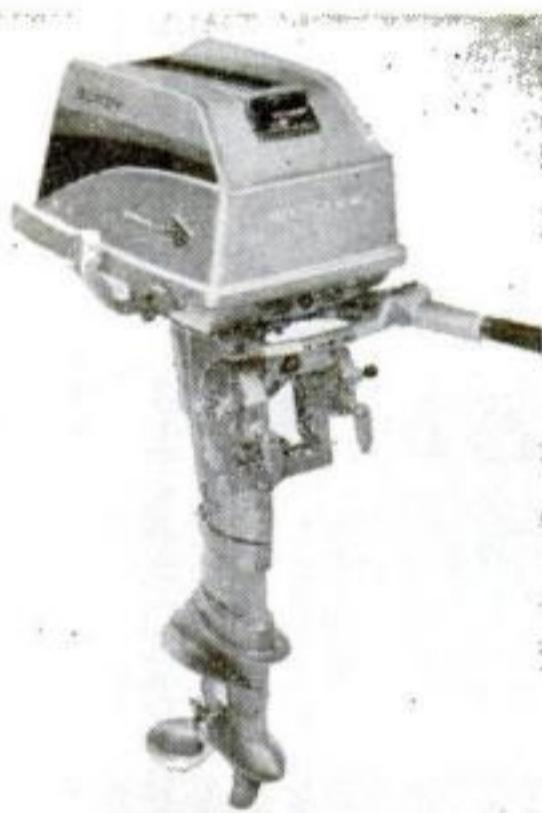


Baby-Size Spray Outfit

This little compressor—eight inches long, eight high, and five wide—is a true diaphragm type like its bigger brothers. It delivers one to two cubic feet of compressed air a minute at 10 to 20 pounds. Nozzle is adjustable. Replaceable neoprene-nylon diaphragm is good for 1,000 hours.

You can use kit to spray paint, oil, insecticides; inflate toys and air mattresses; or as a vaporizer.

Sprayit compressor, gun, and hose sell for \$34.95. Thomas Industries, 207 E. Broadway, Louisville, Ky.



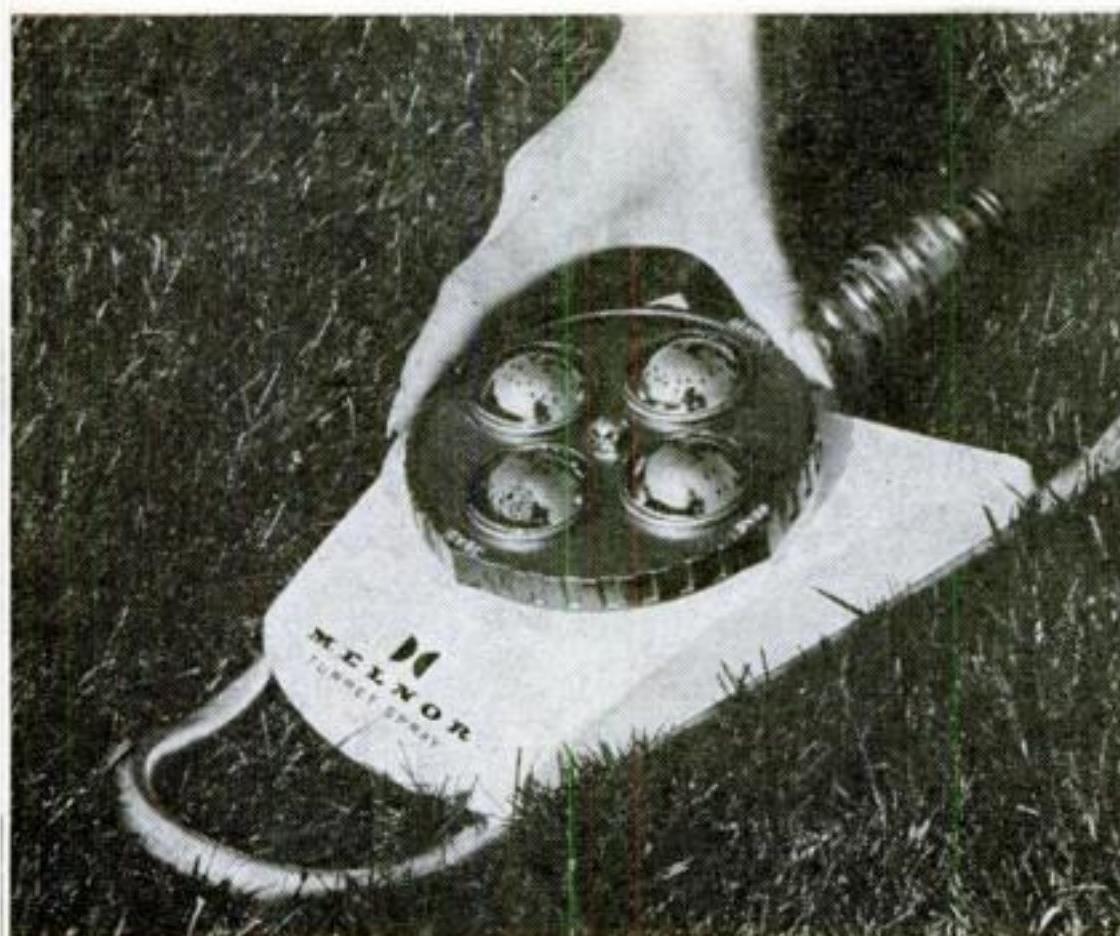
NEW OUTBOARD is made in Italy for a U. S. firm. The 30-hp. motor comes with electric and manual starter, and steering connector arms. There's space for carrying extra spark plugs, drive pins, and cotter pins. \$595. Bundy Marine, Mountainside, N.J.



AEROSOL FILLING KIT enables you to make up spray cans for paints, lacquers, detergents, cosmetics, insecticides, and other household and personal items either from commercial products or your own formulas. The kit shown above includes a pressure gauge, spray containers, valves, dip tubes, plastic collars, metal screw-on caps, a book of instructions, and enough propellants and chemicals to make over 1,000 useful aerosol cans. It sells for \$37.50. Other sizes are from \$10 to \$700. Pressure Pak, Inc., Box 2587, West Palm Beach, Fla.



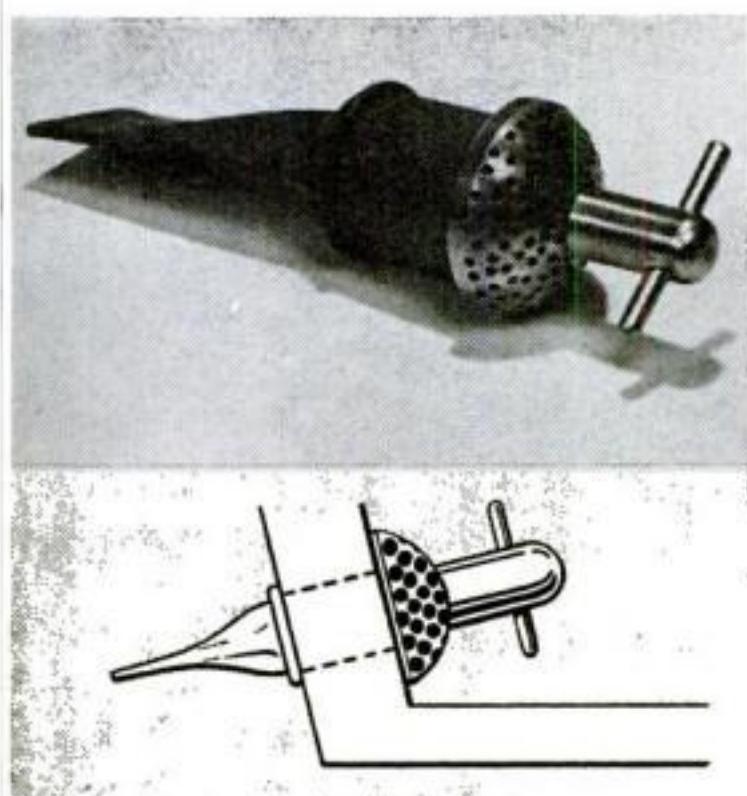
WHAT'S NEW



TURRET SPRINKLER waters 5-by-50 and 10-by-50-foot lawn strips, 20-by-40 rectangles, and 30-by-30 squares. You rotate the head until properly perforated ball nozzle clicks into place over an outlet on the underside. Slides make the sprinkler easy to move. Price, \$3.95. Melnor Industries, Moonachie, N. J.



AIR PUMP plugs into dashboard cigarette lighters of 12-volt cars so you can inflate air mattresses, rubber boats, backyard pools, beach balls, and the like. Lectro-Flate comes with an adaptor outlet that fits various types of valves. \$10.45. Seven Hills Distributing Corp., 121 King St., San Francisco.



BOAT BAILER fits in the transom drain hole and automatically drains water from the bottom as you move the boat forward. A flap valve closes to keep out seepage when you stop. For $\frac{7}{8}$ - and 1-inch holes, \$3.50. L. Guta & Co., 21 Harrison Pl., Clifton, N. J.



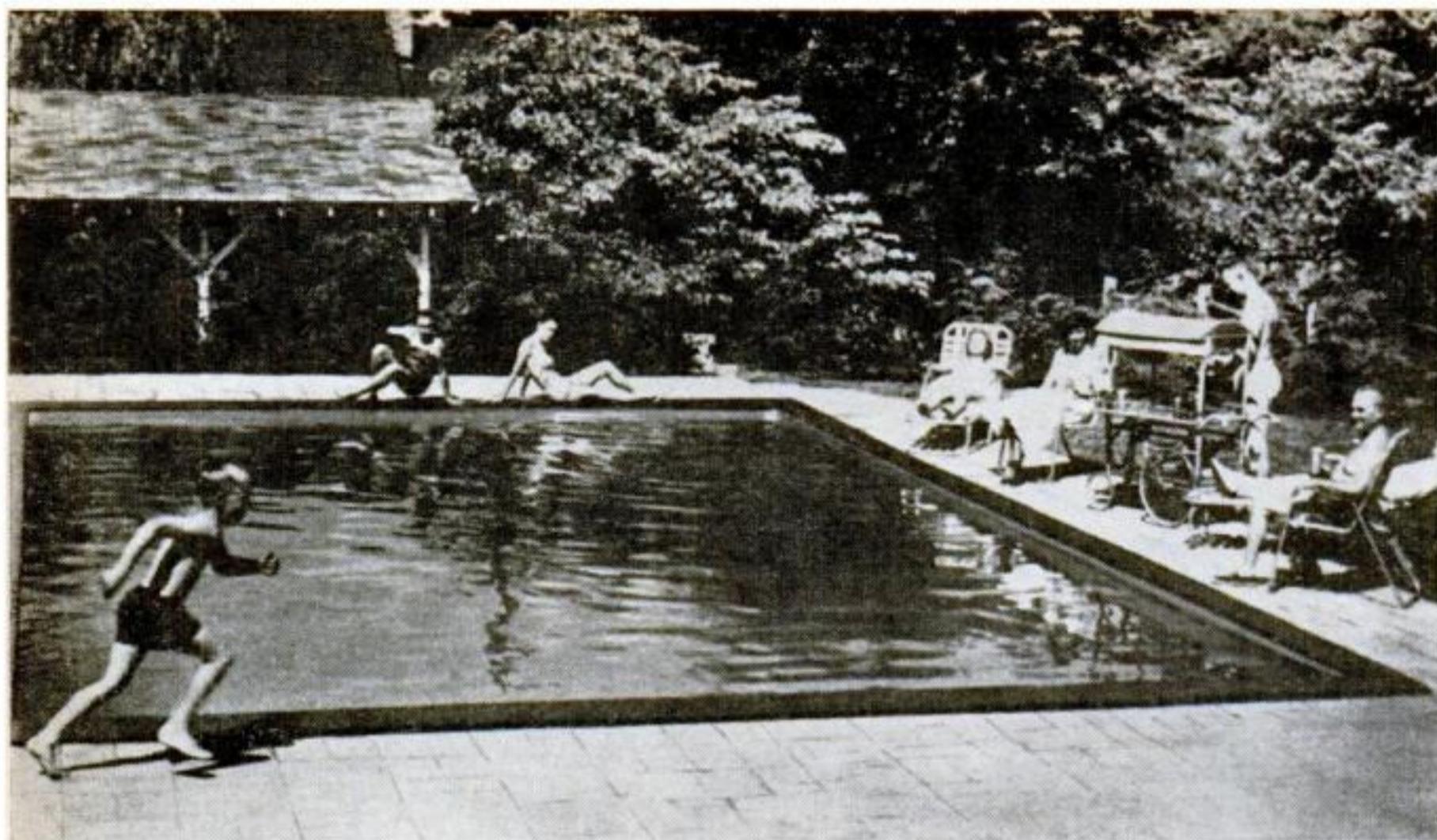
RADIO ALARM has seven-jewel watch on case. Set the dial to your favorite station and alarm hand to desired time, then wake up to music. Transistor radio also turns off automatically in an hour. \$49.95. Matsushita Electric Corp., 41 E. 42 St., NYC.



LEAKPROC is a small plastic tube with a five-inch probe to get into hard-to-reach spots. Lubeall has a probe that closes when you push it down the tube. When you pull it up, the probe opens again. Phadean Engineers, 100 Johnson St., Worcester, Mass.

OILER container is a small plastic tube with a five-inch probe to get into hard-to-reach spots. Valve push when you pull it up. Phadean Engineers, 100 Johnson St., Worcester, Mass.

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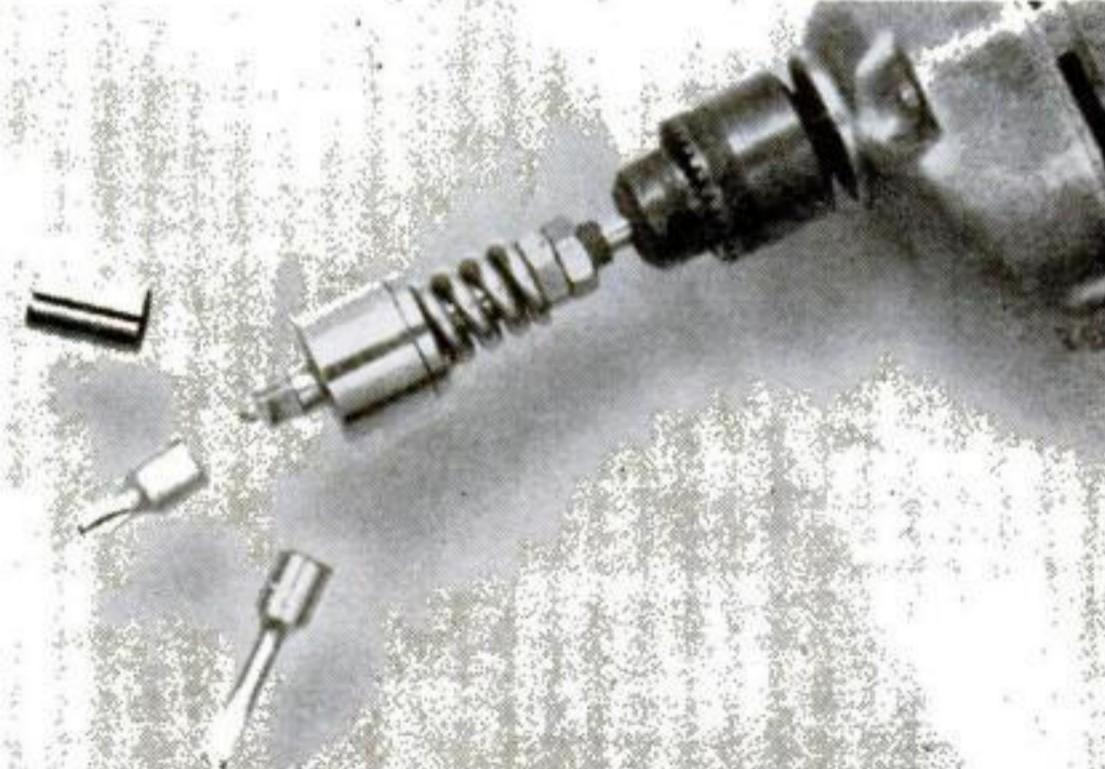
Swimming Pool You Build Yourself

This is a poor-man's version of a build-it-yourself swimming pool that was introduced a year ago [PS, June '60]. It comes in a kit containing rotproofed wood side walls, a one-piece vinyl liner for walls and bottom, filter system, and pool

ladder. It's 12 by 24 feet in area; the earlier, more expensive one is larger: 16 by 32 feet. With continuous 3½-foot depth, \$795; sloping 3½- to 5-foot depth, \$895. You dig your own hole. Cascade Pools Corp., Edison, N. J.



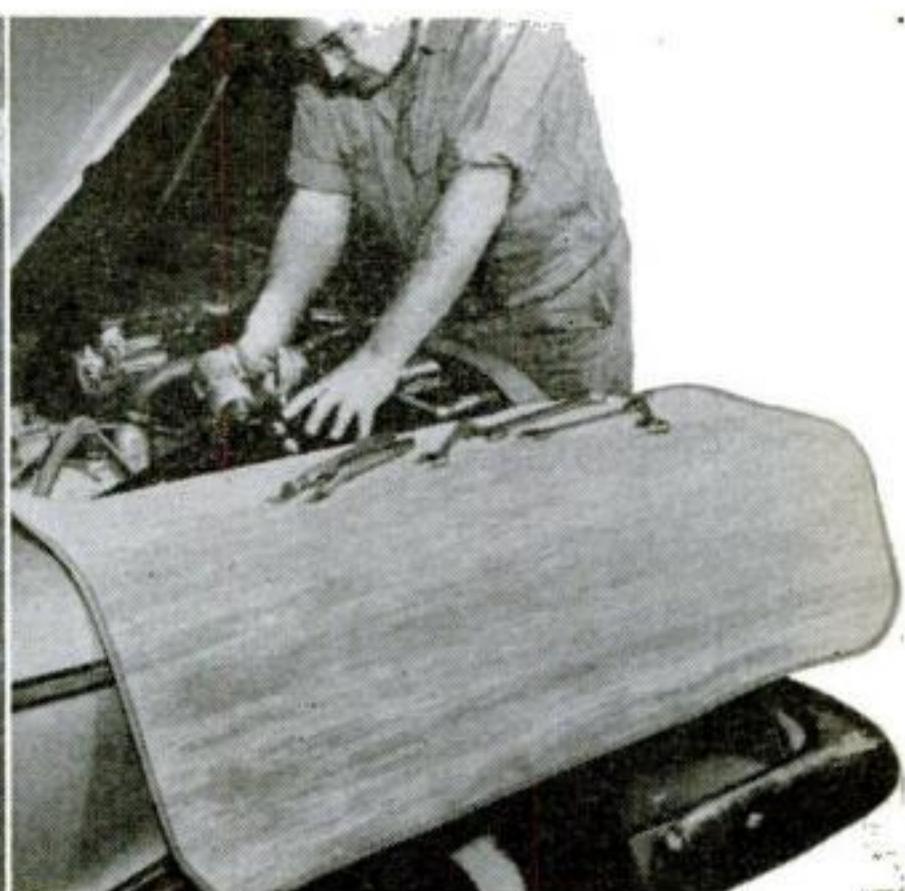
HIGH-LOW WALL SWITCH turns on your room lights to bright or dim. It's a three-position, single-pole switch with full brightness in the high position, 30-percent brightness in the low, and off at center. It is said to save 40 percent on your bill when operated at low and to make bulbs last 20 times longer. \$4.98. General Electric, 95 Hathaway St., Providence, R. I.



TORQUE ADAPTOR converts your power drill to an impact wrench for driving screws and tightening nuts and bolts. It has an adjustable slip clutch to prevent stripping threads when proper torque is reached; a ¼-inch shank that fits the chuck of all home-workshop drills; and straight-, Phillips-, and socket-screw heads. Price, \$8.95. Tools Co., 935 Goodale, Columbus, Ohio.



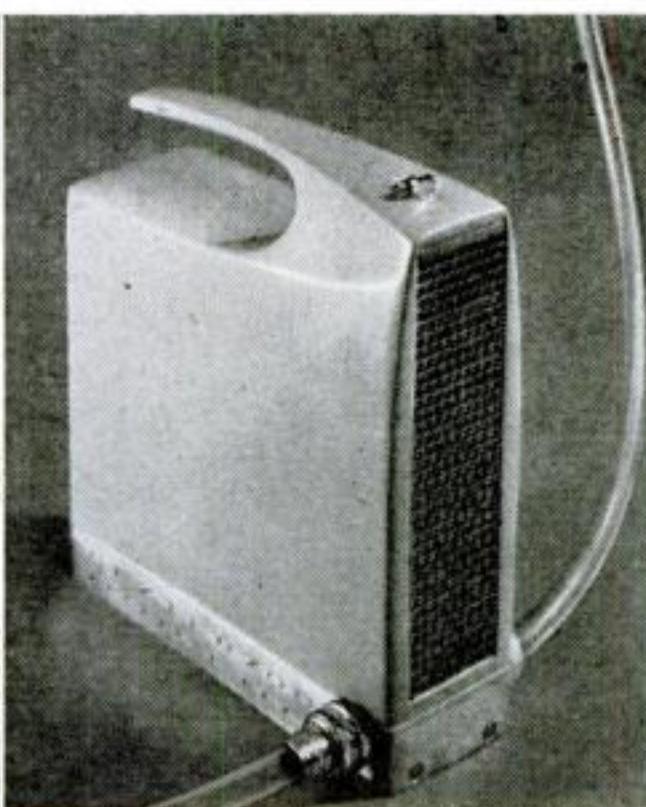
WIRE STRIPPER that clips on the barrel of Ungar soldering tips, cuts rubber and plastic insulation, and speeds a soldering job by not forcing you to change tools. It is available with V-shaped, notched, or round cutting edge. Each, 75 cents. Ungar Electric Tools, 4101 Redwood Ave., Los Angeles.



FENDER COVER is a 26-by-40-inch piece of nonslippling sponge rubber backed by vinyl. It keeps tools and parts from denting or scratching the finish when you work on your car. Oil and grease can be wiped off, dirt washed out. Protect-O-Mat sells for \$4.50. H. B. Egan Mfg. Co., Box 1406, Muskogee, Okla.



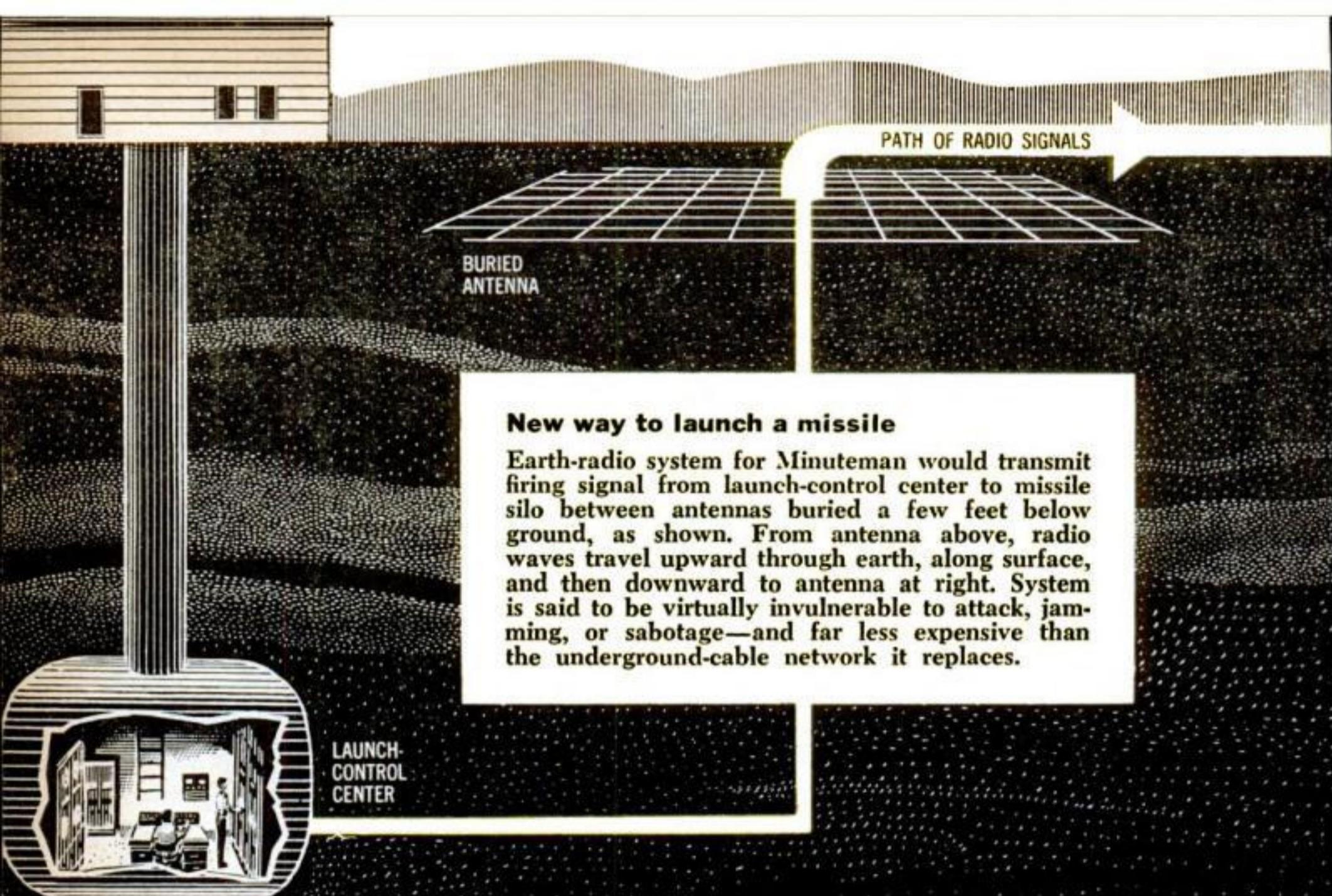
MUFFLER SEALER is a leakproof compound that adheres to metal, hardens without heat or pressure, and resists heat and rust when dry. With it you can refit loose joints and repair punctures or rusted spots. Tube, 98 cents. Devcon Corp., Danvers, Mass.



PORTABLE PUMP runs on two wet cells and plugs into house current for recharging. You can use it in a boat, cellar, or trailer, or even as a camp shower. Dexter pump, with batteries, is priced at \$69.50. Russell Harrington Co., Southbridge, Mass.



TIRE GAUGE is built into the end of this plastic key case. It's calibrated for pressures from 16 to 40 pounds. Plastic case holds door key and two car keys. Clips keep them out of the way when not in use. \$1. Danvern Distributors, Box 453, Willoughby, Ohio.



New way to launch a missile

Earth-radio system for Minuteman would transmit firing signal from launch-control center to missile silo between antennas buried a few feet below ground, as shown. From antenna above, radio waves travel upward through earth, along surface, and then downward to antenna at right. System is said to be virtually invulnerable to attack, jamming, or sabotage—and far less expensive than the underground-cable network it replaces.

How 'Earth Radio' Would Launch ICBMs

By S. David Pursglove

IF THE command to fire must ever be flashed to Minuteman missiles at our newest bases, it will be transmitted by signals pulsing through the earth. The solid-fueled ICBMs' launch-control system will employ a method of communication unheard of, until now, by the general public—underground radio.

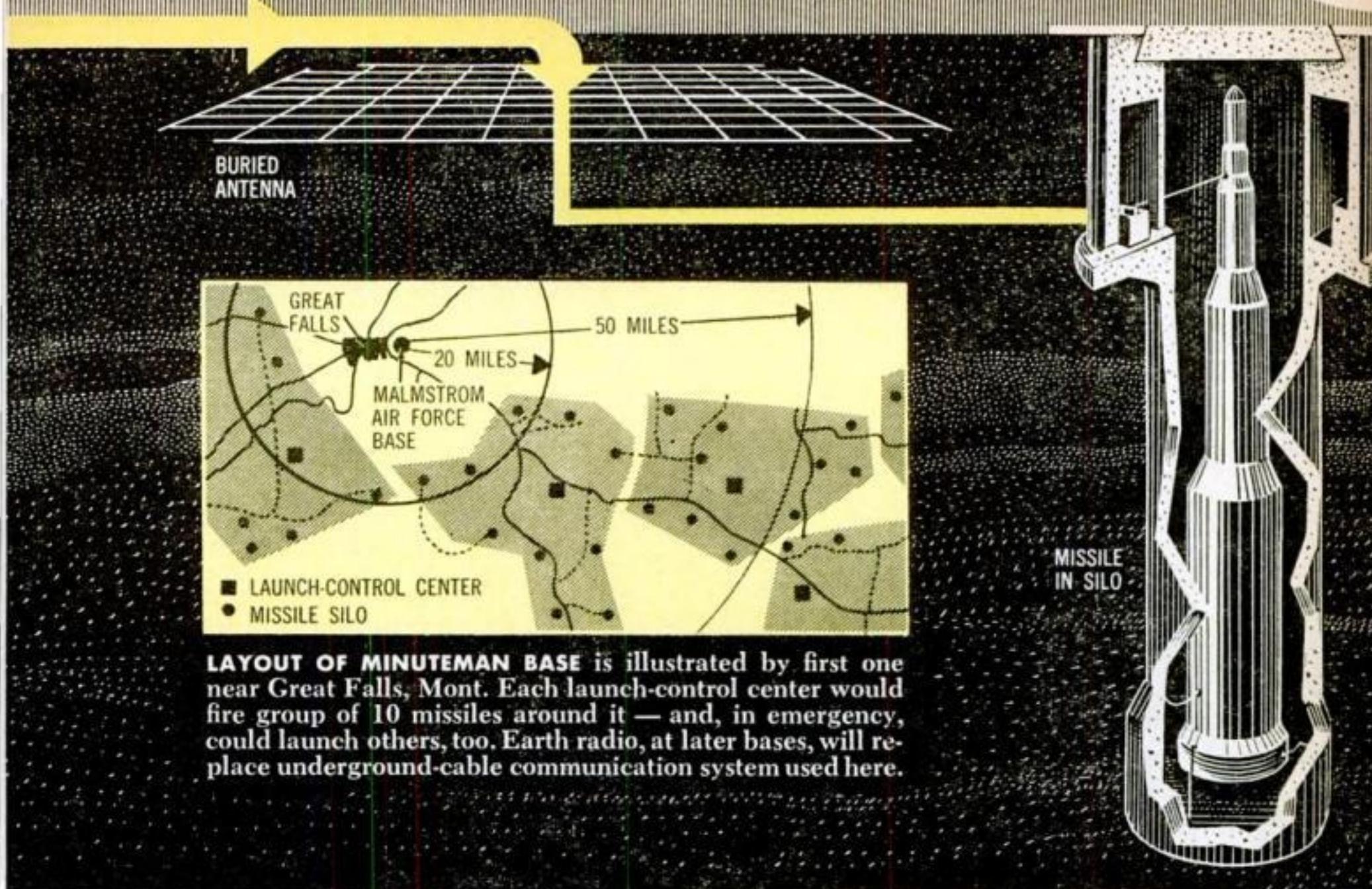
This will be its first practical installation. Its principle, long known to scientists, was crudely applied in World War I and has been experimented with by radio amateurs. But it is only within the last three years that new researches have perfected the radical technique.

As applied for military use, "earth radio" works this way: Signals from an underground transmitter are emitted by a gridlike antenna buried a few feet be-

neath the ground. They travel upward to the surface, and proceed along it—both in the uppermost few feet of earth and in the air just above. Then, descending again, the signals are picked up by a second buried antenna like the first.

Scene of an installation will be a missile base of the latest "hardened" type, designed to withstand a surprise hydrogen attack and still launch its missiles. Out of sight below ground, the ready-to-go Minuteman ICBMs are poised in crewless, bombproof concrete silos, scattered widely about the countryside. The firing command would come by way of manned launch-control centers, "LCCs" for short, likewise underground. If any LCC had been knocked out by a bull's-eye hit, another one would be able to take over and launch its missiles.

Linking LCCs and missile silos, there-



LAYOUT OF MINUTEMAN BASE is illustrated by first one near Great Falls, Mont. Each launch-control center would fire group of 10 missiles around it — and, in emergency, could launch others, too. Earth radio, at later bases, will replace underground-cable communication system used here.

A novel method of subterranean signaling has evolved from a makeshift expedient of World War I. Now it's a practical and invulnerable launch-control system for our newest missiles

fore, calls for an elaborate remote-control communication network, equally proof against full-scale attack or sabotage. Our first 150-silo Minuteman base near Great Falls, Mont., which was planned before the unconventional radio technique was perfected, will use an intricate system of underground signal cables. Earth radio will take the place of most of the cable network at other Minuteman bases soon to come.

It's cheaper. Big advantage of the novel radio system is that it eliminates cable costing \$20,000 to \$25,000 a mile. That means a saving of about \$300,000 per missile, the Air Force estimates.

"We are convinced that the system is practical," says Lt. Gen. B. A. Schriever, commander of the Air Research and Development Command. "It will be a virtually jamproof communication network,

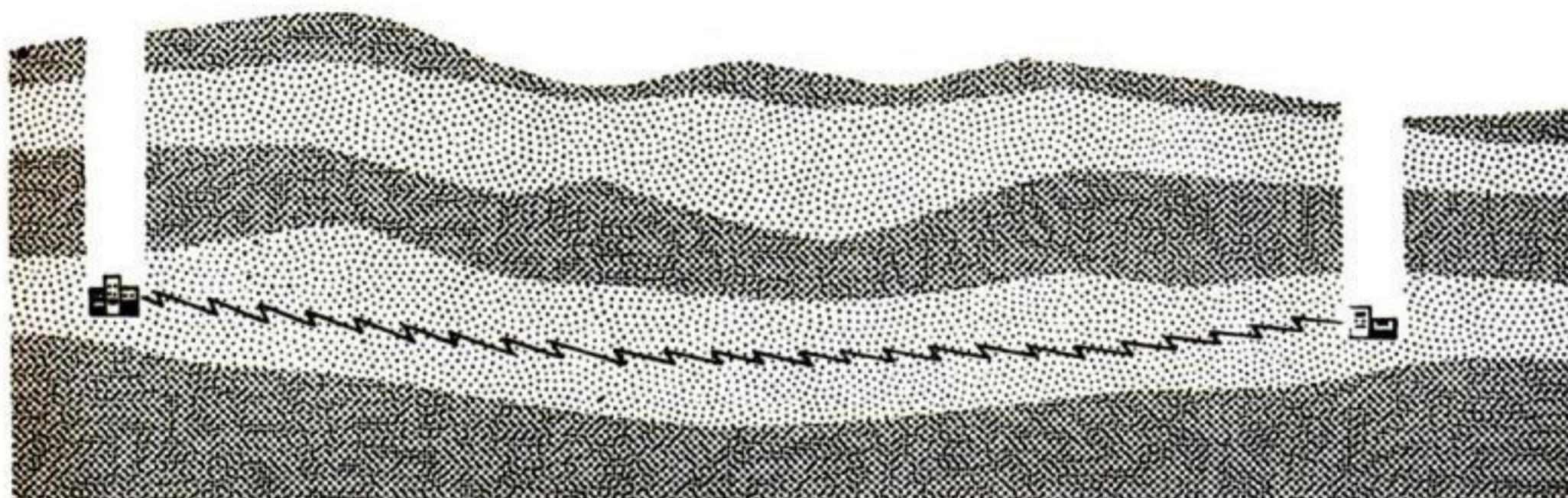
and highly invulnerable to sabotage." While details are largely secret, this much more is revealed about the system: It will provide "a continuous report on the status of each missile" and of its silo. And it will use "spread-spectrum" transmission, meaning that its radio waves will have a wide range of frequencies. This guards against deliberate interference; a prohibitive amount of power would be required to jam the whole range.

The story behind earth radio goes back to World War I, when the German advance on Paris cut off a French army unit from its main force. The unit's signalmen, the tale goes, thrust two bayonets into the ground a few feet apart. They attached a buzzer, to serve as an oscillator, and had a crude wireless-telegraph transmitter. Meanwhile the main body of French troops—following instructions

CONTINUED

III

A deep-down version of earth radio, for civilian uses,



SIGNAL TRAVELS through deep layer of rock, in Lithocom earth-radio system. Adjacent layers form boundaries of a natural waveguide, extending range of radio waves.

ON WAY TO WORK, the radio experimenters ride through tunnel of potash mine near Carlsbad, N. M. Starting a 7-a.m.-to-11-p.m. day, they quipped, "Back to the salt mine."

from a runner who had gotten through—set up a similar receiver, using headphones instead of a buzzer. The “earth wireless” worked—and the code messages led to the rescue of the trapped men.

The hams tried it, too. In later years, amateur radio experimenters have tinkered with the scheme. Instead of connecting his sending-receiving outfit to antenna and ground, a ham would make one connection to a grounded water pipe—and the other to a metal rod sunk in the earth some distance away. Then he could exchange signals with another amateur, living nearby, who had done the same.

The trouble was, such experiments showed, that earth radio had a much shorter range than conventional radio—and took more power to span equal distance. So it remained just a scientific curiosity, until the coming of the missile age finally brought a use for it.

Development of Minuteman’s shallow or surface-hugging system of earth radio began in mid-1958. Under an ARDC con-

tract, experimenters of Space Electronics Corp., Glendale, Calif., conducted subsurface trials under water and in a mine. Eventually they reported obtaining a strong signal more than 1,000 miles from a transmitter of 250-kilowatt power output.

Special antennas for the system were tested by the Boeing Airplane Company in earth-radio trials of its own, and transmitting and receiving equipment was developed by Sylvania Electric Products. The National Bureau of Standards also lent a helping hand.

Early last December, the Air Research and Development Command—considering the adoption of the earth-radio launch-control system for Minuteman—began a full-scale trial to confirm its practicality and reliability. In February of this year, the ARDC announced that it intended to use the system.

Radio through rocks. Meanwhile another kind of earth radio, called Lithocom, has been independently developed

gets a successful tryout at 1,000-foot depth



TEST CENTER for deep transmitting trials occupies end of abandoned gallery in potash mine. Long earth-radio antenna, at left, runs along its roof and floor. Teletype is in background.

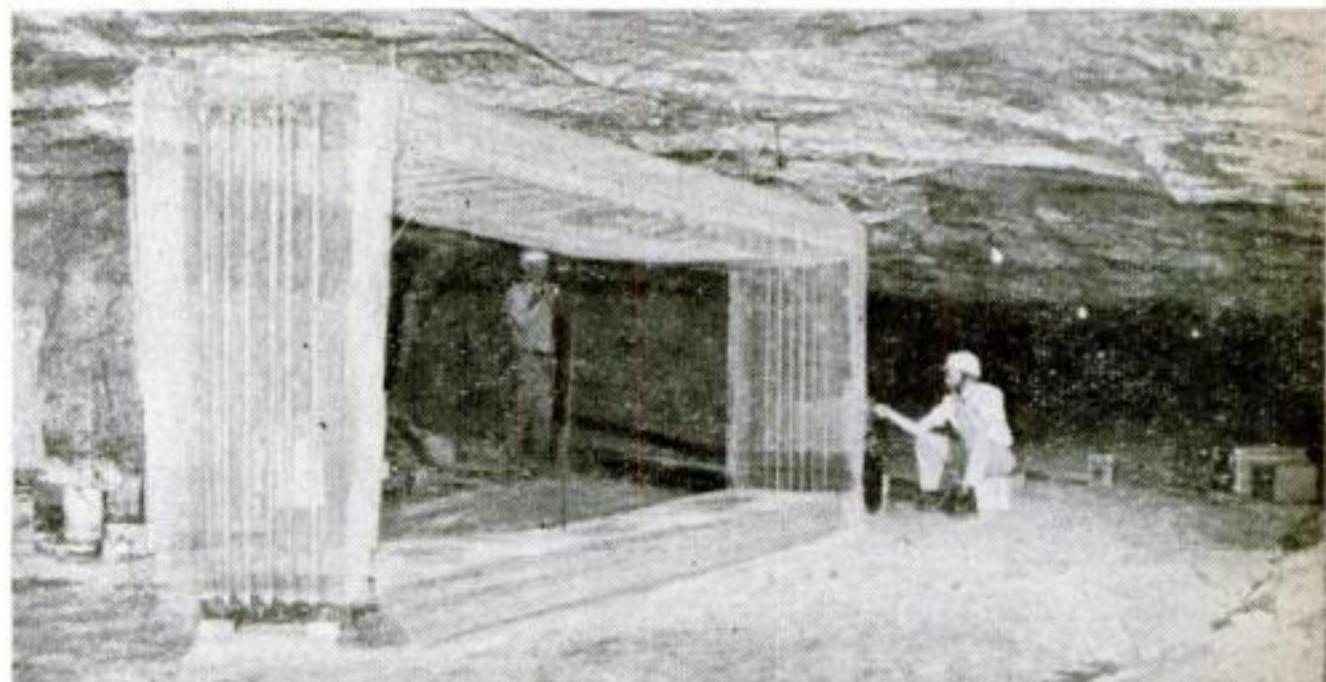
CHICKEN WIRE and heating pipes make up this underground-radio antenna—one of a number of experimental ones tried out by Deco engineers to transmit signals through earth.

by an Eastern firm. In contrast with the Air Force's "shallow" system, this is a "deep" one—its waves travel through subterranean rock without ever approaching the surface. Civilian applications, principally, are foreseen for it.

Lithocom was born in mid-1959, when recent geophysical studies suggested that deep-down radio was feasible. Although radio waves peter out comparatively quickly in deep rock, engineers of the Developmental Engineering Corp., Washington, D. C., theorized that their range could be greatly extended by taking advantage of favorable rock formations.

In the earth's upper crust, for example, a dry layer of sedimentary rock bounded by moist conducting ones should form a natural "waveguide" or conduit for subterranean radio waves. And so should a readily available "laboratory model"—a natural underground bed of salt, with an overburden of more-conductive rock.

Ready for actual trials by February, 1960, Deco engineers invaded two mines



near Carlsbad, N. M., that had offered to cooperate. They set up their transmitter in an abandoned portion of the Potash Company of America workings, where the ore had become too thin to

[Continued on page 201]



SUCCESS rewards experimenters as radio-teletype message travels record 4½-mile distance through earth, at 1,000-foot depth, from machine in photo to similar one in another mine.

**Outriggers keep boat steady on water . . .**

. . . rotor sails it through the air.

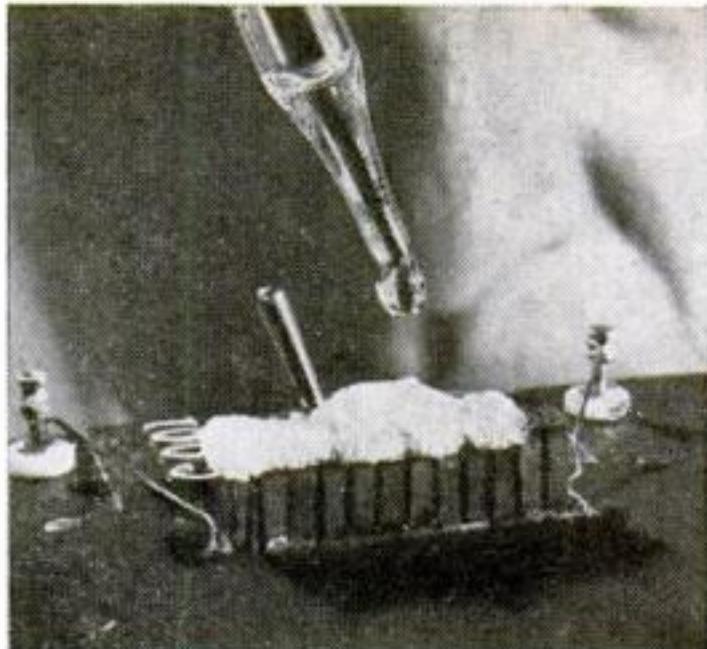
Whirly-boat takes to air

Towed by speedboat at 20 m.p.h., the contraption above will actually fly. It has outrigger floats for stability in the water and a rotor on top of a short mast to provide it with wings. John Hofsteter, young British aircraft designer, spent four years building his Gyroboat, tested it successfully on the Thames near London.

**Overhanging missile trailer**

More than 64 feet long, this trailer still conforms to state highway regulations: A cutout at front lets several feet overhang the tractor.

The vehicle, 10 feet wide and $13\frac{1}{3}$ high, weighs 36,000 pounds empty. A combination transporter and erector for the Air Force's Minuteman intercontinental ballistic missile, it was developed under Boeing direction by GM Truck and Coach Division, Cessna Aircraft, and Bendix.

**Electronic icemaker**

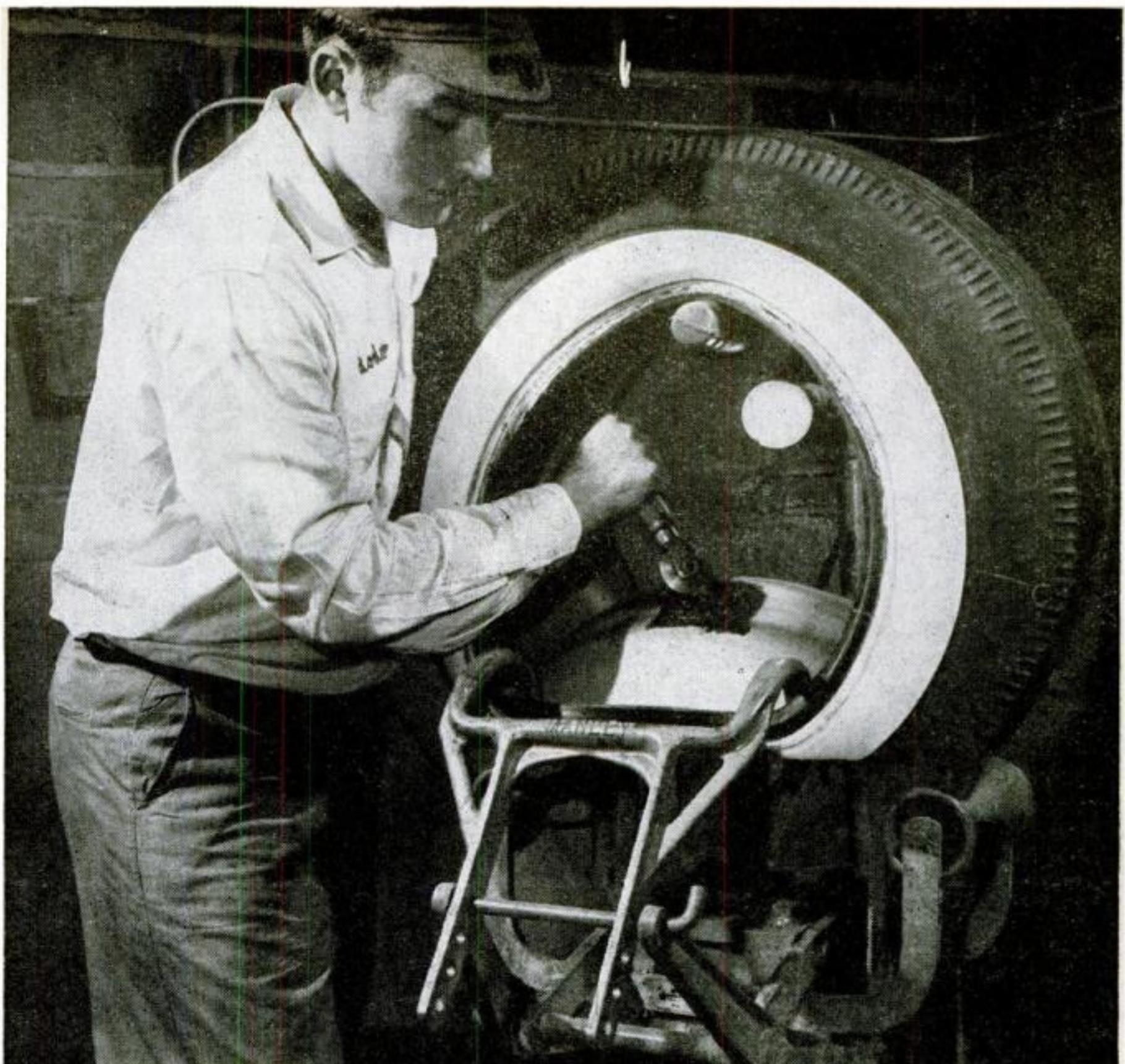
This tiny device brings closer a no-moving-parts refrigerator. It uses a tenth the current of other thermoelectric devices. These pump heat from one side of a crystal assembly to the other when electricity passes through, working as either coolers or heaters.

New materials enable Hughes Aircraft's crystals to freeze a drop of water, using two flashlight batteries—two amps cools it to -100 degrees. It melts again at the flick of a switch.

**Not for the birds**

The thatched roof of the historic cottage of Anne Hathaway, William Shakespeare's wife, is covered with a Dacron netting.

It forestalls the birds at Stratford-on-Avon. They had been flying off with the straw each spring to build their nests.



Patch repair is shown by Bodo Fischer, foreman, U.S. Royal Tire Center, Ossining, N.Y.

The Truth About Patching Tubeless Tires

There are many dangerous ways to repair nail holes and breaks—but only one safe way

By Robert Gorman

ONE myth that's sweeping the country is that you can't properly fix a tubeless tire. Your best bet, many repairmen will tell you, is to install an inner tube in your tubeless casing.

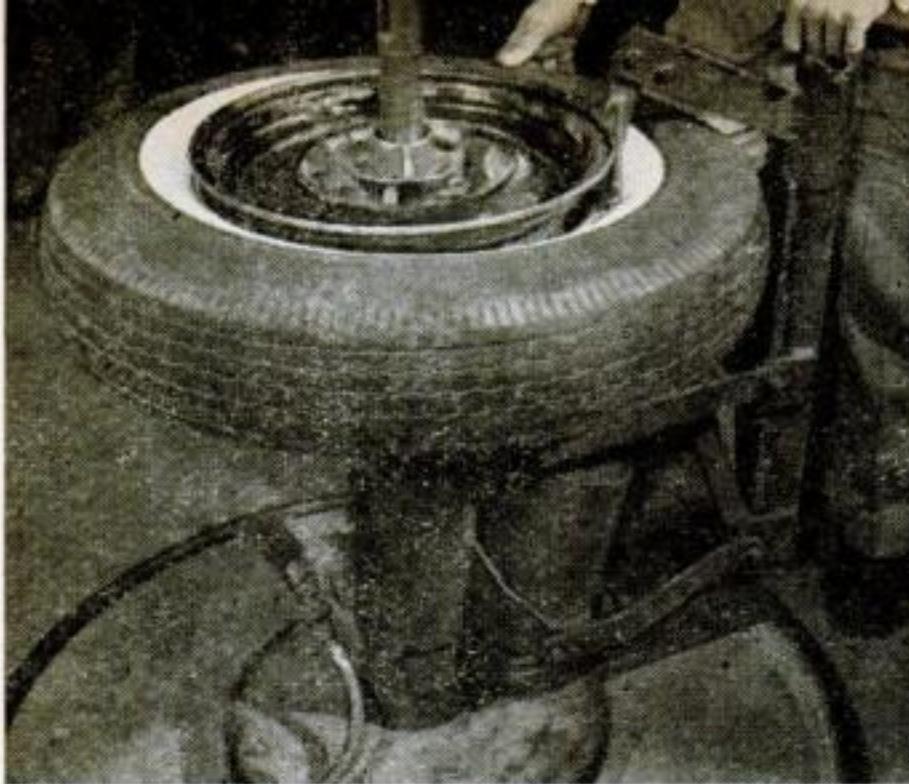
Nine times out of ten this is expensive—and dangerous—advice. If a tubeless tire can't be put back in service as a tubeless, according to tire-company experts, it's usually not safe as a tire.

Surveys show that at least 90 percent of all flats result from small punctures or breaks that can be repaired safely. When you use a tube either to backstop or to take the place of a repair, you make a tire less safe and shorten its life.

In nearly 10 years of use, tubeless tires

CONTINUED

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1 MODERN SERVICE STATIONS have automatic demounters that break the air seal without damaging the rim or bead. These machines apply even pressure at top and bottom of tire.

have proved much better air holders than tube-and-tire combinations. They demand less attention and less frequent air checking. Flats are less frequent, and are more likely to be gradual because the tire's inner liner, backed by fabric and rubber, tends to hold a nail or other puncturing object. Thus the air escapes in a slow trickle.

Also, tubeless tires are lighter in the tread area. That means they ride and steer easier, run cooler, and are less subject to blowouts. This is an impressive list of advantages. But you erase all of them when you install a tube.

What happens if you use a tube? If you use a tube in place of a repair, you have a less effective air holder than before. And the next puncturing object will cause a quick instead of a slow flat.

5 NAIL HOLE IS REAMED carefully from the outside with a power-driven rat-tail file. This operation roughens the hole, enlarges it slightly, and cleans out rust, dirt, and bits of rubber.

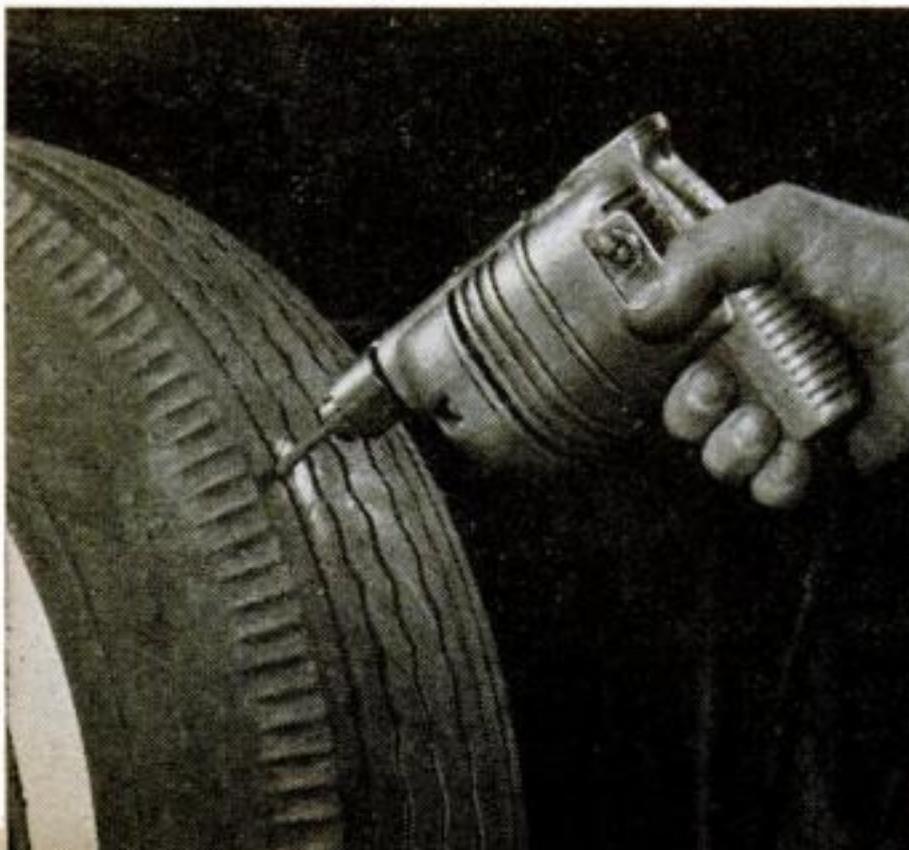


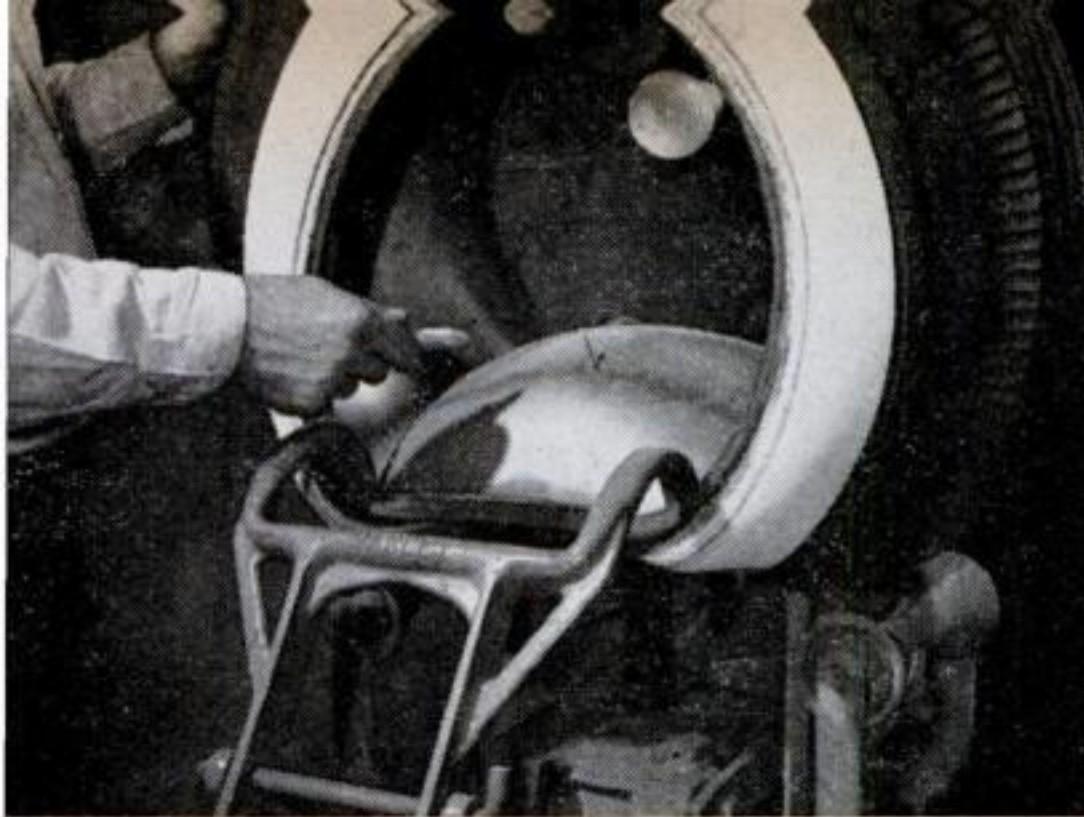
2 ROLLER IRON lifts the bead over the wheel rim. Unlike a pry bar, iron has two rollers at the tip, at right angles to each other. It rolls, rather than pries, the tire's bead free.

Though the air loss may be slowed a little by the undamaged part of the liner, you can't count on this very much, or for very long. Left unrepaired, a small puncture enlarges itself by flexing, and collects dirt and moisture that eventually rots the cord.

The second common way of misusing tubes eliminates some of these dangers but creates new ones to take their place. Many drivers think they can bolster a repaired tubeless tire by adding a tube. But tubes and tubeless tires were not meant to go together. Regular tube-type tires are vented—not air-sealed—around the tire bead and wheel rim. When you put a tube in a sound tubeless tire, you create one air pocket inside another. As you drive, trapped air heats up and expands. Since it can't escape, it exerts

6 THREADING TOOL, similar to blunt awl or pick, forces a strip of uncured gum rubber into the hole. Driving heat will vulcanize the gum to form a dirt- and water-proof filler.





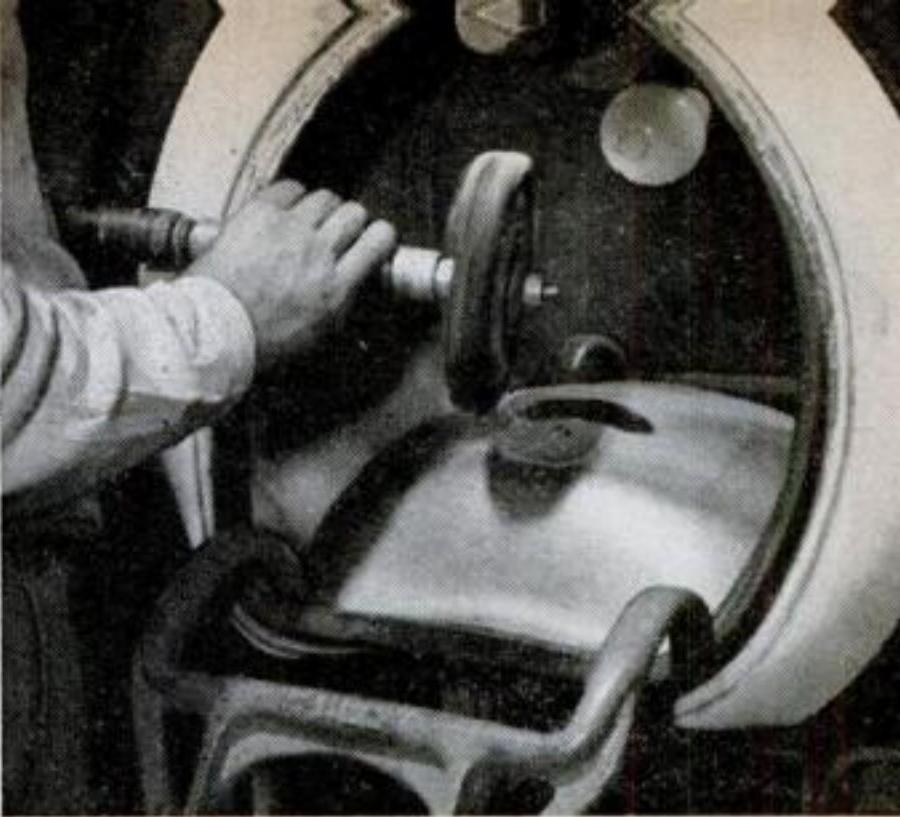
3 SPREADER exposes the inside of the tire for easy inspection. The entire casing should be checked carefully for nails and breaks before it is remounted on the wheel rim.

pressure on weak spots in the tube or on cracks in the liner. Pocketed air greatly increases the danger of tread separation or blowout at high speeds. And the extra weight of a tube makes the tire run hotter and stiffer.

Hiding poor workmanship. At its best, then, putting a tube in a tubeless is like sweeping dirt under a rug. It is favored by some untidy repairmen because they can charge more for a quicker and easier job. A tube also helps conceal new damage they may inflict on your tire through poor workmanship or out-of-date equipment.

Why then, you may ask, has it been common practice for retreaders to buff off the word "tubeless" and sell their recaps with tubes? What can be wrong with adding a tube if it's done by reputable re-

7 VULCANIZING CEMENT is applied over buffed area and patch is pressed on. Edges are firmly bonded to the tire with the help of a manually operated roller like this one.



4 WITH NAIL HOLE AS THE CENTER, an area slightly larger than the patch to be used is chalk-marked on the inside of the casing and power-buffed to remove the liner coating.

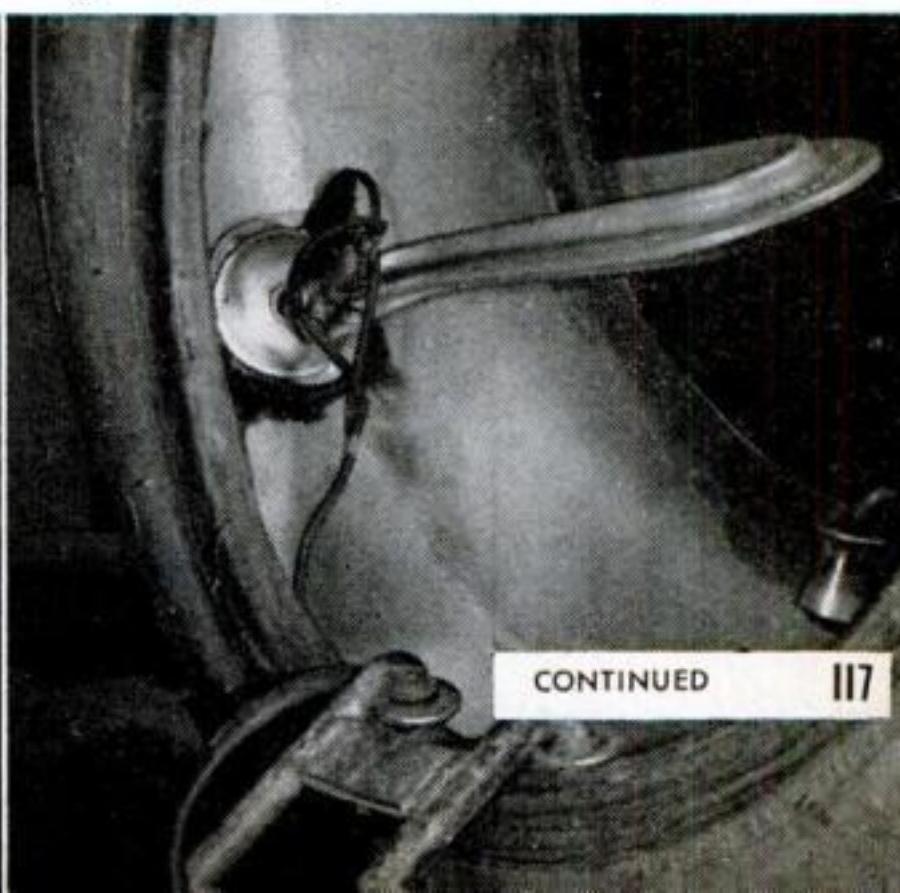
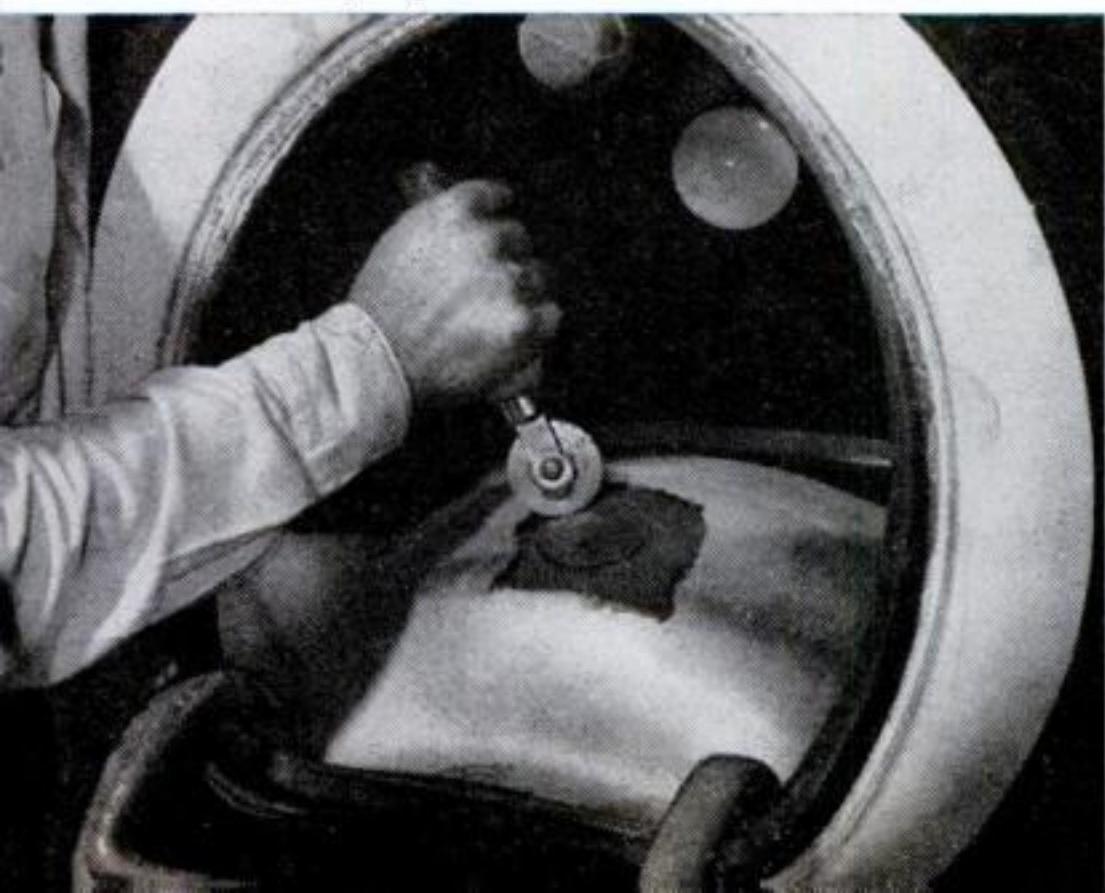
tread shops—including those owned by major tire companies?

There's a simple answer. A retreader doesn't just add a tube; he *converts* the tire by venting it around the sidewall to eliminate pressure build-up. A properly converted casing is as good as—though no better than—a standard tube-type tire.

Retreaders have converted many tires because the casings on which they operate are at least a couple of years old. The linings in many older tires tend to dry out, crack, or blister, though this is less true of tires made in the last few years.

There are other reasons for confusion. When tubeless tires were first introduced, manufacturers were uneasily aware that new techniques and equipment were needed for proper service. But these just weren't available, and service couldn't

8 HEAT AND PRESSURE are applied to the patch by a clamped-on electrode (transformer box is not shown). Cold-setting patches are popular, but probably less satisfactory.





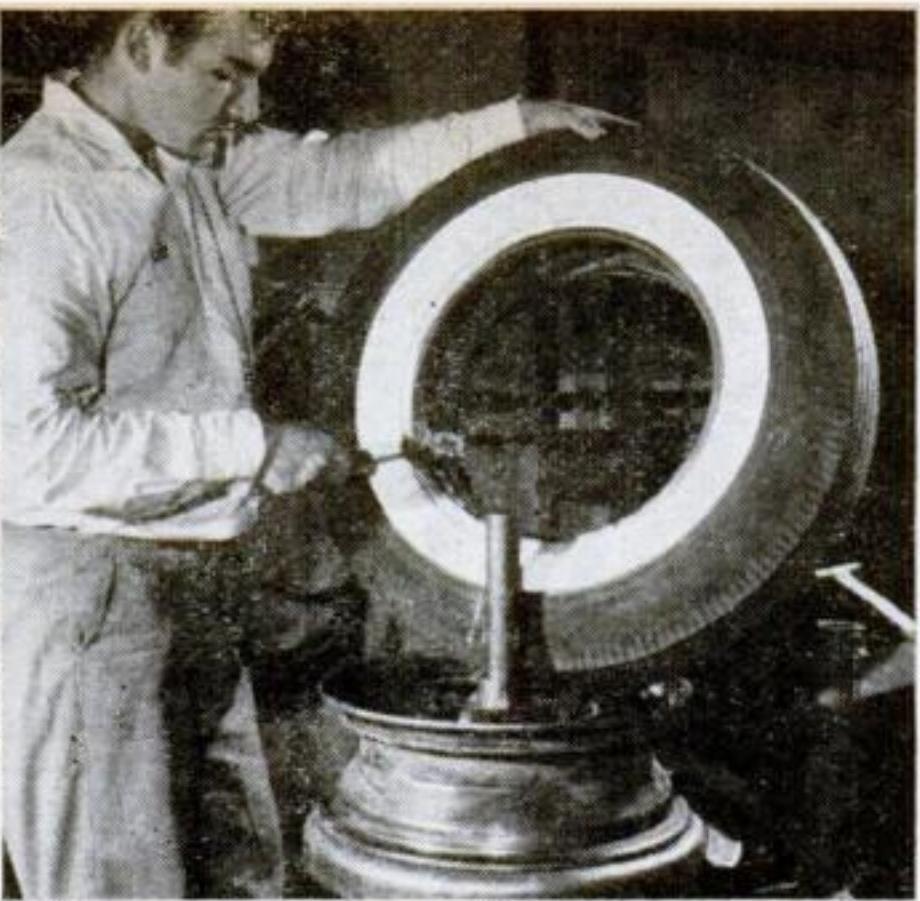
9 RUST AND DIRT are wire-brushed from the rim. If necessary, dents in the rim are hammered out. It's also a good idea to check the valve; often it needs to be replaced.

wait. So while tubes were never recommended for the repair of tubeless tires, neither were they outspokenly condemned. Tubes help cover up faulty repair work, and in the early days of tubeless tires a staggering number of repairs needed cover-up.

The bang-and-pry days. Hammers and tire irons were then the standard equipment for removing a tire from its wheel. They carried over into the tubeless era not because they were satisfactory, but because nothing better was at hand. Tire manufacturers had to settle for service manuals showing the least-bad ways of getting a tire on and off. Since the bang-and-pry technique often damaged the tire bead and wheel rim, tubes were frequently needed to complete a repair.

In the same era, rubber companies came up with another compromise. To avoid the necessity of removing a tire, many of them put out plug-type repair kits. Outside-in plugs could (and still can) be inserted without demounting a tire. Plugs have not been very satisfactory, however, either in repairing a break or in preventing its spread. So while the same companies still sell plug kits, they have recently agreed to downgrade the kits in their literature. Plugs are now officially listed by the industry for temporary service only.

This "harder" line is possible because automatic demounting machines are now



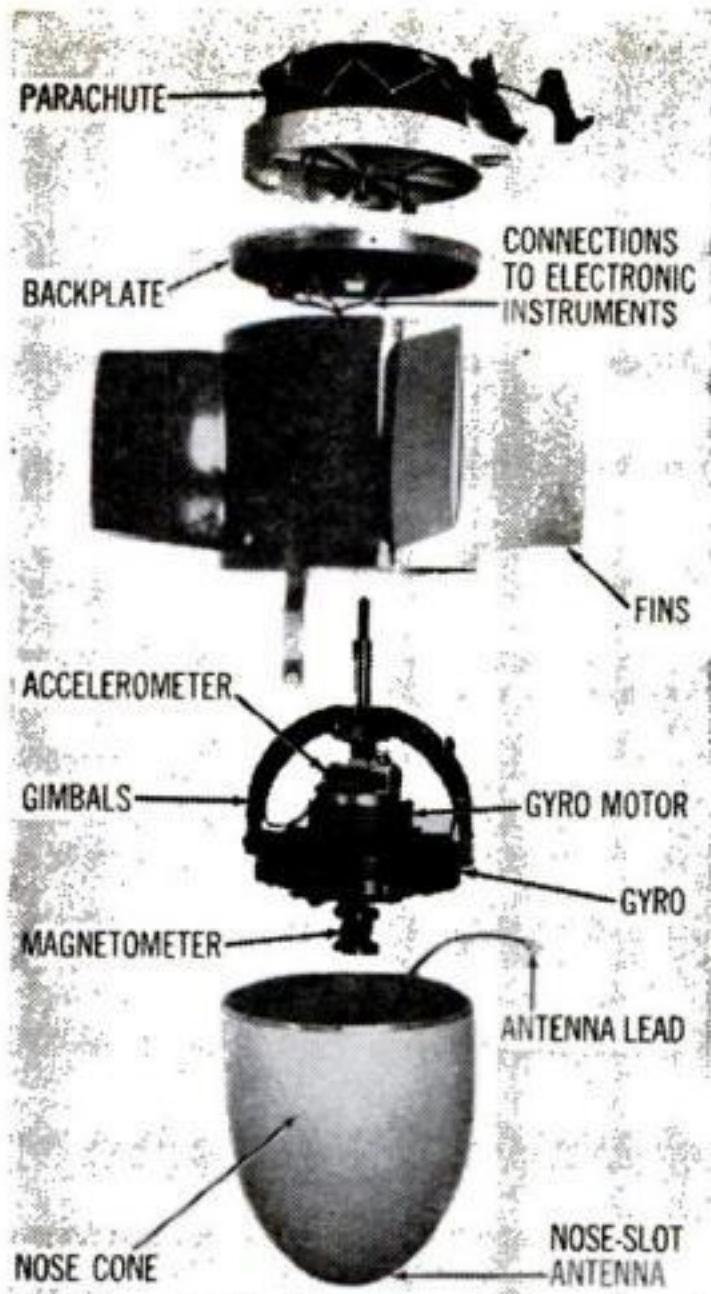
10 BEAD IS LUBRICATED before remounting to ease it over the rim and to help make a smooth, airtight seal. The demounting procedure is reversed during the tire reassembly.

in general use in up-to-date tire-service stations. Industry experts can therefore be more outspoken about letting a repairman attack your tire with a hammer and irons. Their advice is: Don't. And don't try to repair it yourself. Tubeless-tire repair calls for the right equipment, and for a man who knows how to use it.

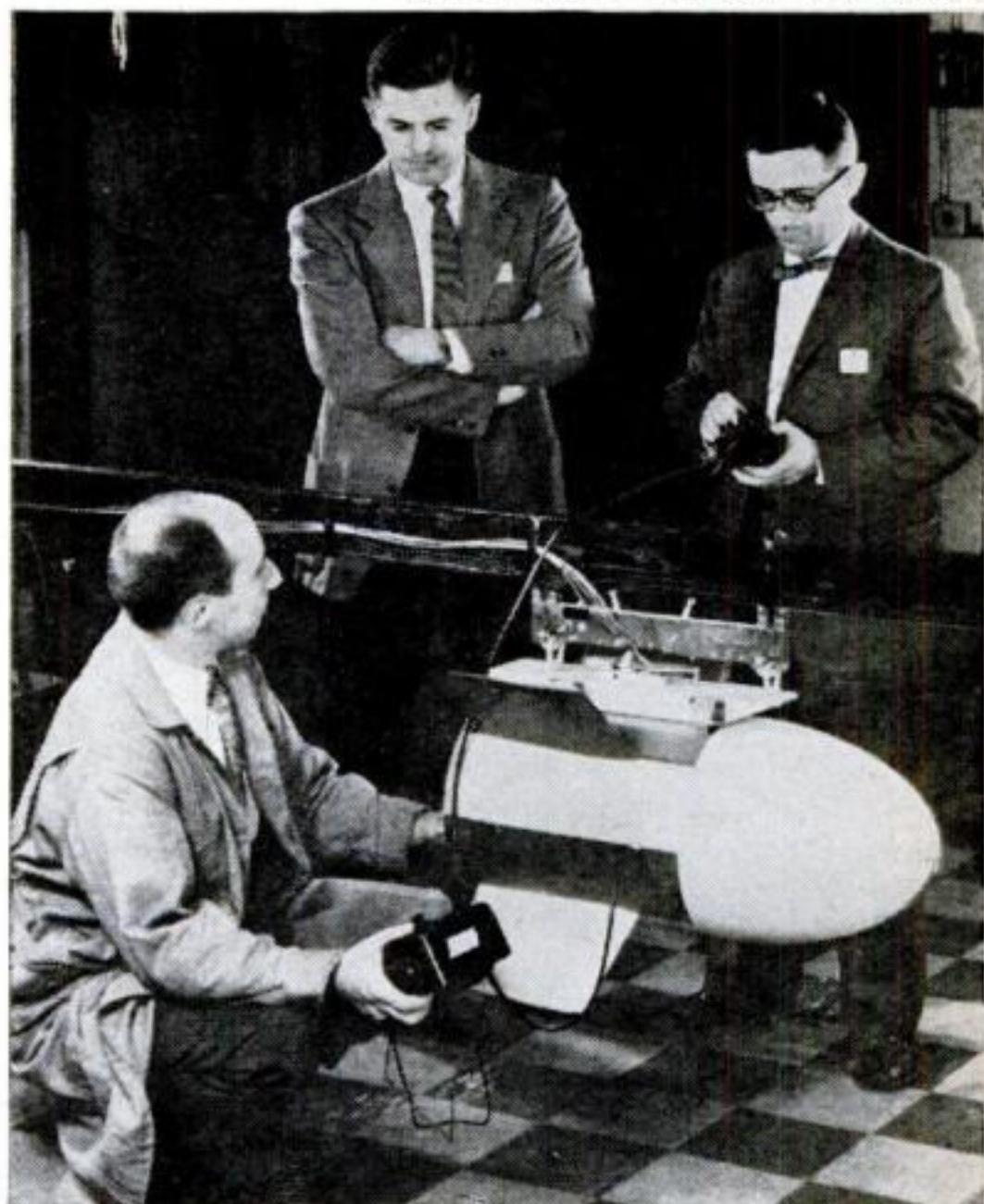
How should the repair be made? The list of approved methods has shrunk down to one: the vulcanized filler and patch applied from the inside. (See photo sequence.) This method applies only to punctures or breaks under a quarter-inch. Fortunately this covers the great majority of tire injuries.

Small holes grow. But it doesn't give you much leeway to play around with unrepairs breaks, or to use a tube as a means of postponing a repair. Left unfixed, a small hole can grow into a major break. Once it exceeds a quarter-inch, your tire is on the way out.

It's not that major injuries can't be repaired safely, but rather that you won't be happy with the result. The weight of the patch will throw your tire permanently out of balance and cause a noticeable thump if it's used on any late-model car. You could have it retreaded as a snow tire (which will make the thump less noticeable), or keep it as a limited-service spare. But either way you'll have to add lost tire life to the cost of "fixing" a flat with a tube.



EXPLODED VIEW shows parts of device that record wind force and direction.



ELECTRONIC GEAR housed inside wind sonde is checked out by technicians to assure perfect performance.

Bombing the winds

Air Force and Navy hurricane hunters, flying next month and until the end of the season in November, may drop "bombs" like this into the hearts of tropical storms moving up from the Caribbean.

Called a wind sonde, the device will radio wind direction and force at all altitudes. Its 13-inch-diameter "warhead"

packs a gyroscope that keeps the 27-inch body upright during its fall to the sea.

Force and direction of wind against its fins are registered by electronic instruments and transmitted by radio to the plane above. There the information is recorded, put through a computer, and radioed to weather stations in the storm's path. Wind sondes are made by Allied Research Associates, Inc., of Boston.

Jointed Army truck

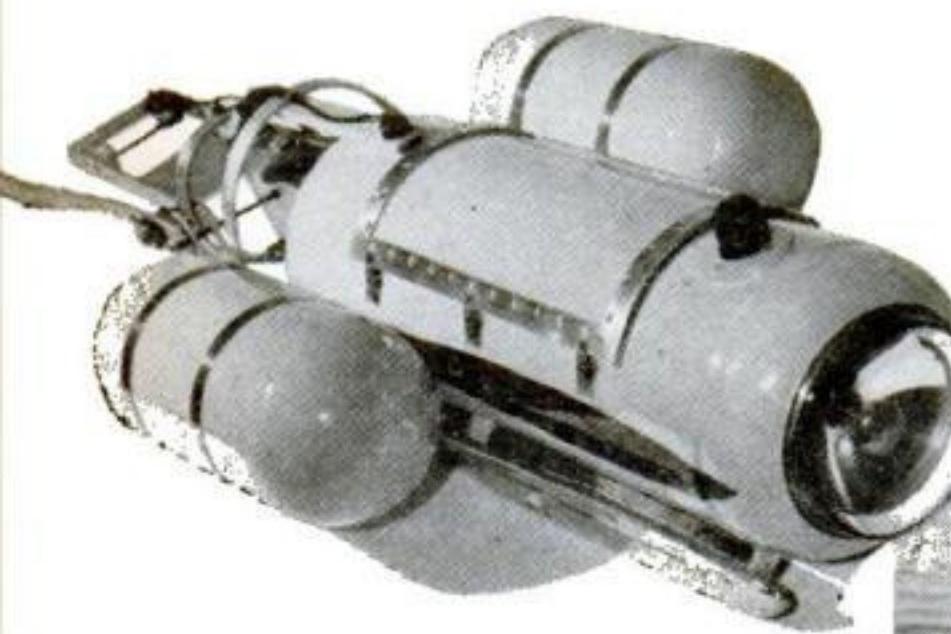
This six-wheeled amphibious military vehicle will do almost anything but climb trees. The Gama-Goat, designed by Rodger L. Gamaunt of Fawn-skin, Calif., and built by Chance-Vought Aircraft, can negotiate rough ground, ditches, snow, sand, swamps; and swim rivers. Its 80-hp. air-cooled engine will speed it up to 50 m.p.h., do 1,000 miles on a tankful of gas.

The rear body is detachable and can be interchanged for transporting troops, cargo, ammunition, a missile, a flame thrower, or an ambulance.

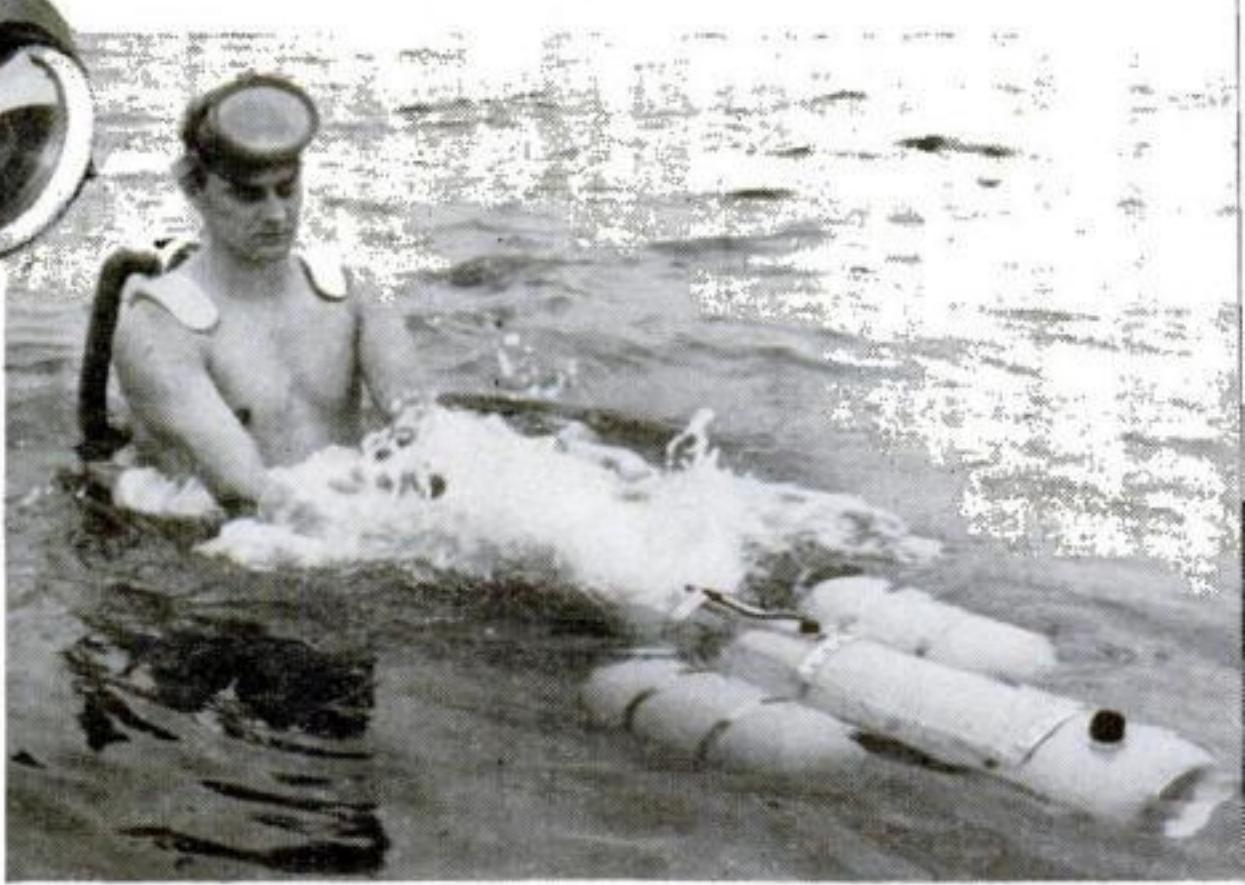


THRILLING ANSWER TO A SKIN

Homemade Diving Scooter



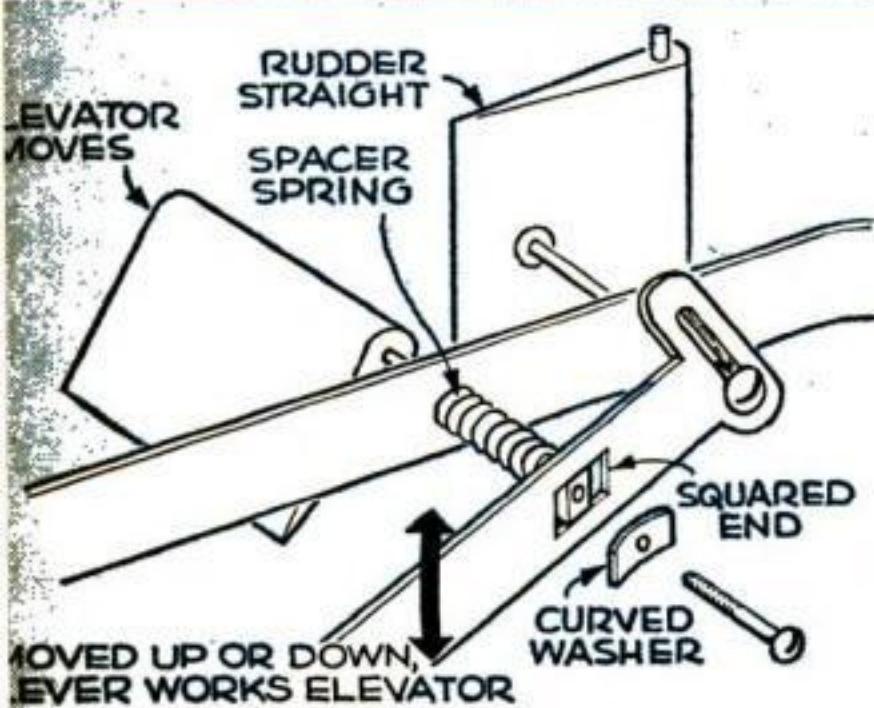
It dives, climbs, and banks like an airplane, runs on a battery, and was built of junk parts and ingenuity



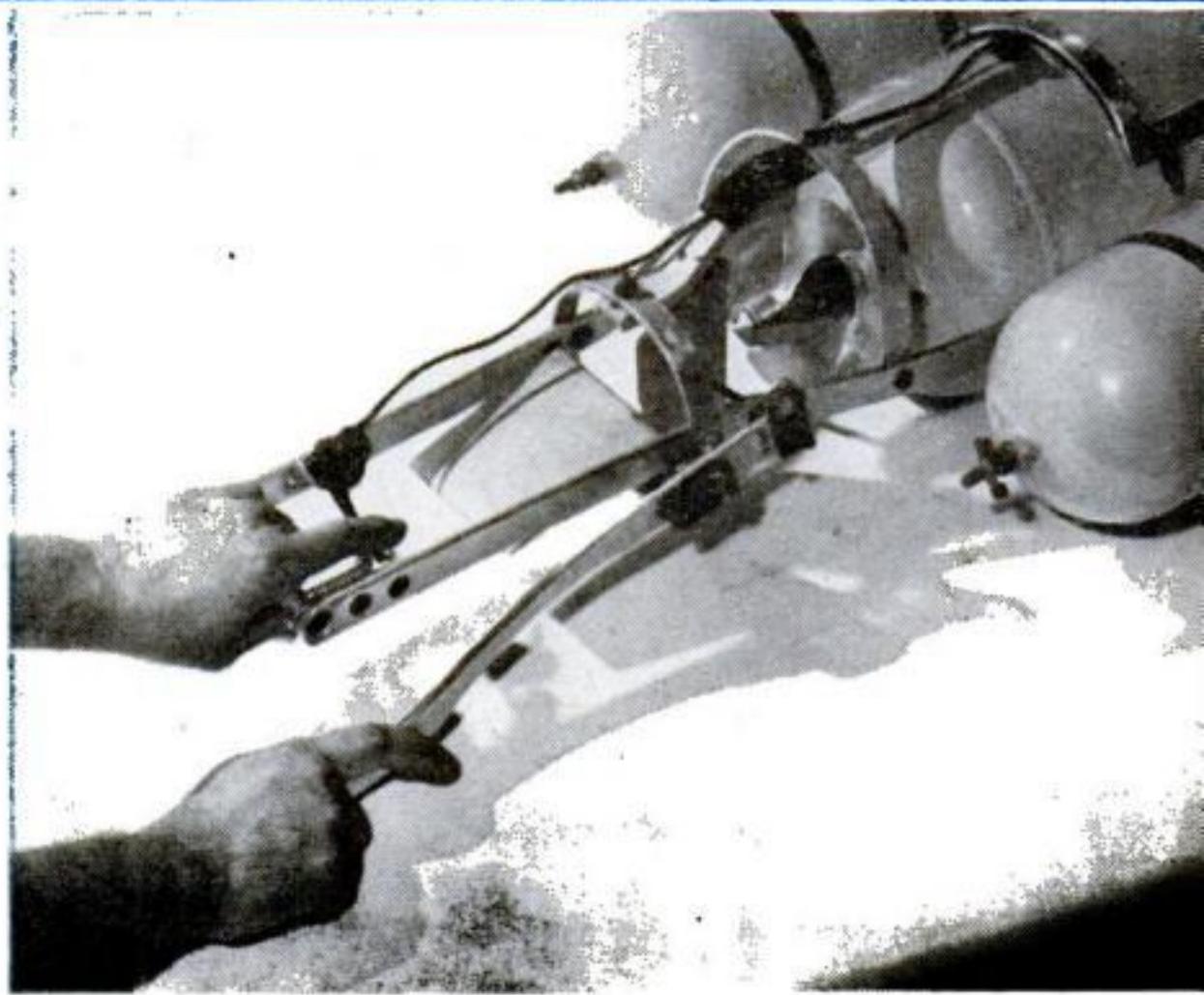
SIDE TANKS, added for buoyancy, also carry a reserve supply of compressed air. Runners, on which the scooter rests on land, were salvaged from an old tank-type vacuum cleaner.

SURGE OF FOAM churned up by spinning prop at surface gives hint of scooter's power. Joe Pulaski, its builder, hangs on behind scooter, keeping his head well above the propwash.

Single lever controls elevator and rudder simultaneously



MOVING LEVER UP OR DOWN tilts elevator. Rudder rod slides in slotted guide, so steering is not affected. Rudder and elevator were filed from $\frac{1}{4}$ " aluminum plate. Shafts are press-fitted in holes drilled in edges, and pinned in place.



DIVER'S DREAM:

Mechanics
and Handicraft
SECTION

Roams the Deep

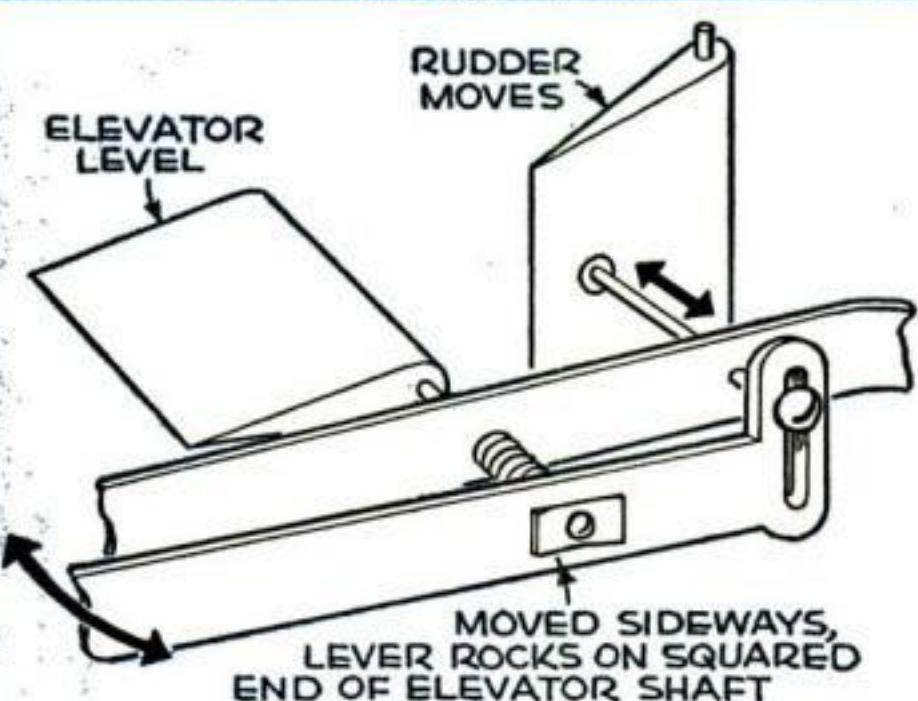
By Herbert R. Pfister

PS PHOTOS BY W. W. MORRIS

"I THOUGHT I had all the gear a skin diver could need until I saw an underwater scooter on television. I made up my mind then that I'd own one by this summer. But, boy, what prices!"

That's how Joe Pulaski Jr. of Fords, N.J., explains how a truck air-brake tank, two surplus oxygen tanks, and a motor that once lowered a convertible top came to be assembled into the good-looking underwater scooter shown here.

"I'd been diving for years and never knew what I was missing," Joe told me. "Now, besides being able to range twice as far underwater, there's a new freedom in swooping up or down at will, or skimming along the bottom without effort." He grinned. "I don't know how you hitch a wagon to a star, but I'm sure that

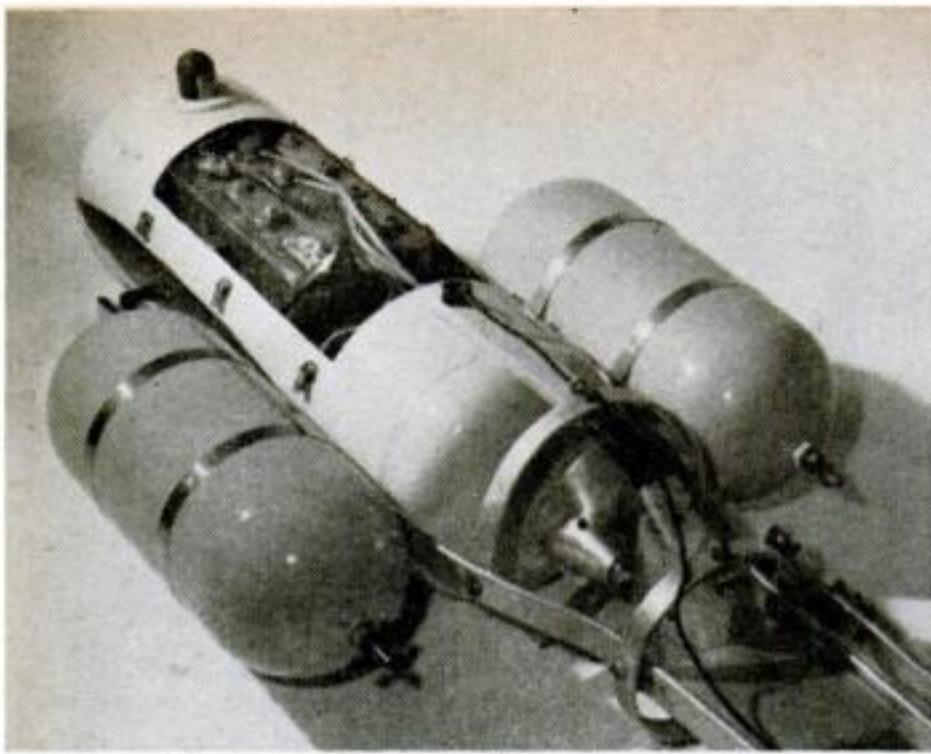


SWINGING LEVER FROM SIDE TO SIDE causes rod to push or pull rudder to left or right. Spacer spring permits lever to rock on squared end of elevator shaft. Moving lever diagonally operates the elevator and rudder together.



CONTINUED

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RUBBER-LIPPED HATCH can be removed in an instant by unsnapping six luggage fasteners. Note how the battery fits inside the main tank with just a fraction of an inch to spare.

hitching onto my scooter has it beat."

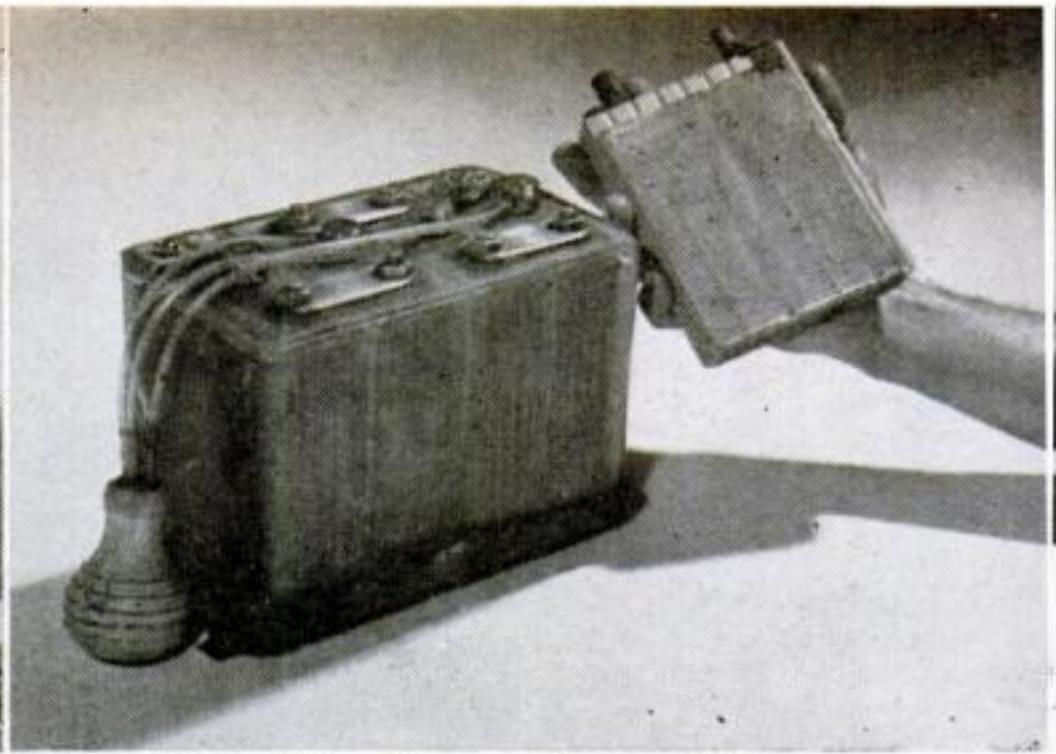
Almost everything that went into the scooter was junk—the kind anyone can find in junk yards, surplus stores, or basement corners. Pulaski even built in an old sealed-beam headlight. The lower filament was burned out, but the high beam was still good.

To get inside the main tank, he hacksawed a rectangular opening in its side. This isn't as tough a job as it seems, as truck air tanks are fairly thin-walled. A lip of $\frac{1}{8}$ " aluminum was riveted around the edges of the piece cut out so that it overlapped the opening by about $\frac{1}{2}$ " on all sides. Rubber, cemented to the underside of the lip, made the hatch cover watertight when pulled down by six small luggage clips bolted to the lip and the tank.

The motor and solenoid switch fit easily into the tank. To seal off leaks at the shaft, a packing gland was brazed over the air fitting at the end of the tank. The gland is kept just tight enough to seal the shaft without causing it to bind.

A two-blade, $6\frac{1}{2}$ "-diameter propeller, bought used from an outboard-motor dealer, seems to drive the scooter at top speed without loading the motor.

An opening, slight-



FOUR CELLS, like the one being held, were taken from a new dry-charge battery and packed into plastic case built to fit tank. Rubber bulb catches any fluid that might overflow.

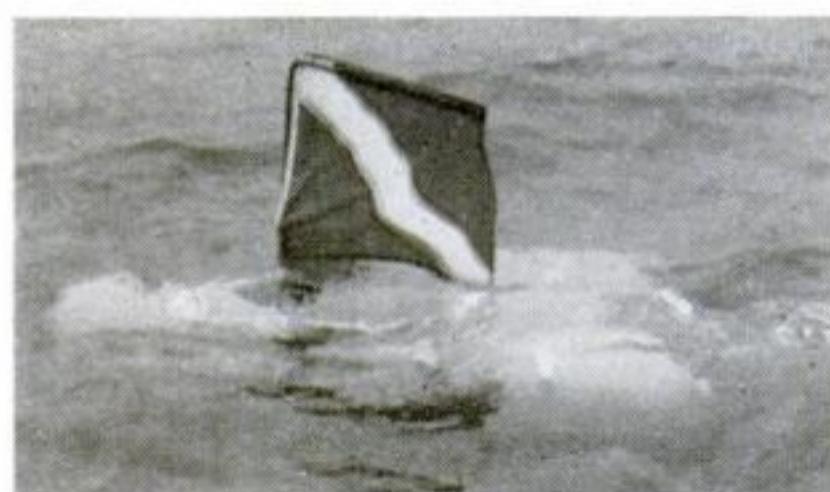
ly smaller than the diameter of the headlight, was cut in the round end of the tank. Four clips press the light firmly against a rubber gasket inside the opening. To protect the glass, a headlight rim was brazed to the outside of the opening.

A headlight dimmer switch was installed under a rubber dome. Such domes are sold in surplus stores or by outboard-motor dealers. Pressing the rubber actuates the switch below.

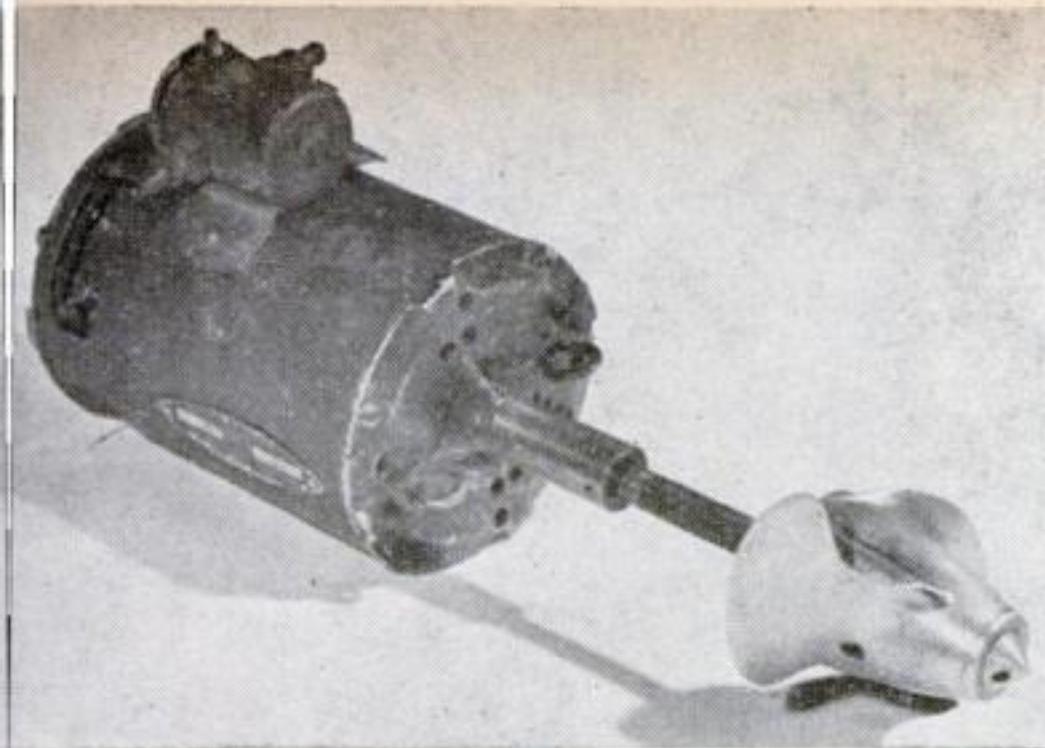
The battery. Fitting a husky battery inside the tank presented a problem that was easily solved. Pulaski bought a 12-volt dry-charge battery, took it apart, and reassembled four of the six cells to make an eight-volt power pack that really spins the six-volt motor. A plastic case, with bottom rounded to fit the tank, was built around the cells and cemented together with plastic cement. To prevent spilling the electrolyte when maneuvering the scooter, he connected flexible plastic tubing—the type used in home aquariums—to the cell caps and ran them to a rubber bulb from a battery hydrometer. Any fluid forced out of the cells collects in the rubber bulb.

Wood cradle blocks cemented to the inside of the tank keep the battery from shifting.

The two side tanks



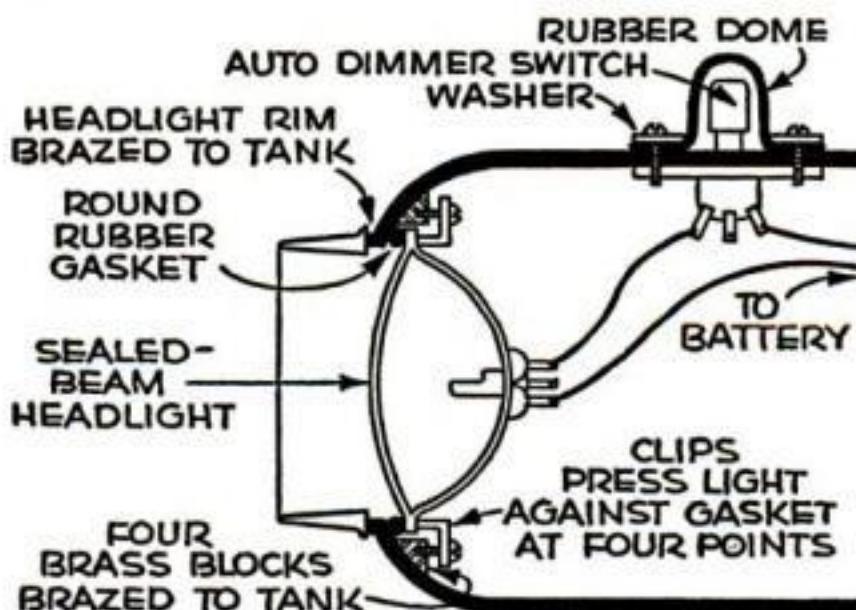
DIVER BELOW! Scooter is allowed to float to surface a half-minute before diver comes up. Skin-diver flag, held on scooter by suction cup, warns boats to stay clear.



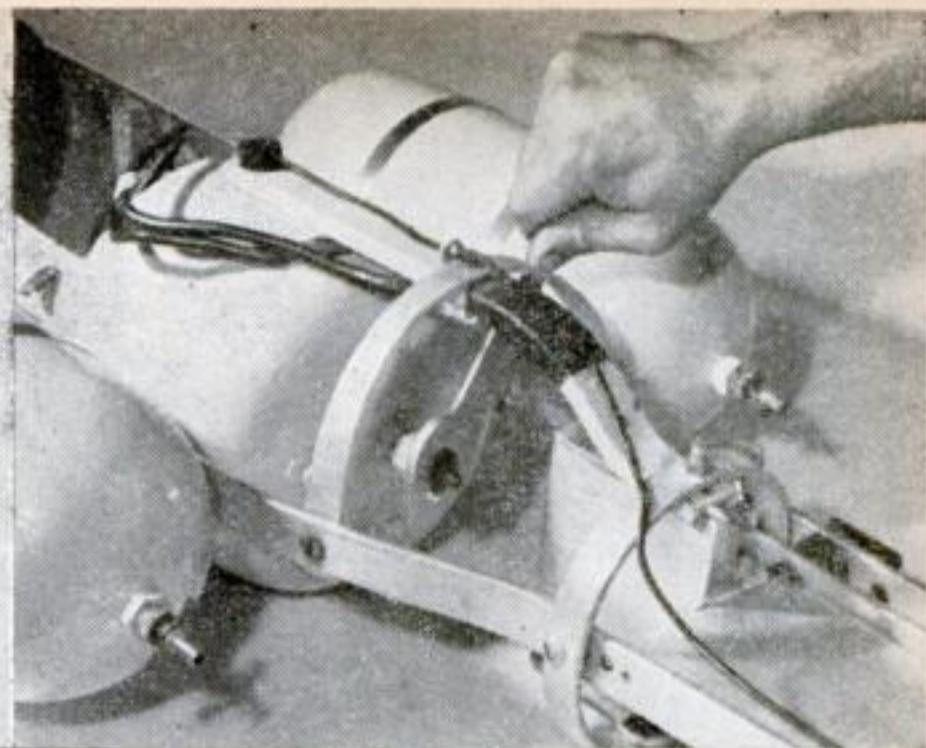
SHAFT EXTENSION on motor is arbor normally used to mount grinding wheel or buffer on a shop motor. Outboard-motor prop is fastened to extension with shear pin and cotter pin.

are strapped to the main tank. They can be moved to the front or rear as needed to adjust the trim of the scooter. Their main purpose is to provide buoyancy for the heavy main tank, but 300 pounds of air is pumped into them for reserve breathing in case anything should go wrong with the diving lung. A truck-tire valve was installed in the side of the main tank so that the tank can be pressurized with a short air hose from one of the outrigger tanks when diving in deeper water.

The controls. All home-built, the controls are supported by a strap-iron frame, which also serves as a propeller guard. The rudder and elevator are operated with the right hand by a single lever.



HEADLIGHT. An old sealed-beam lamp is pressed snug against a large O-ring gasket by four clips. Machine screws, threaded into four brass blocks brazed to the tank, tighten up the clips. A headlight rim, brazed around the lamp opening, protects the glass from accidental breakage. An on-off switch is sealed under a watertight rubber dome. Pressing the dome works it.

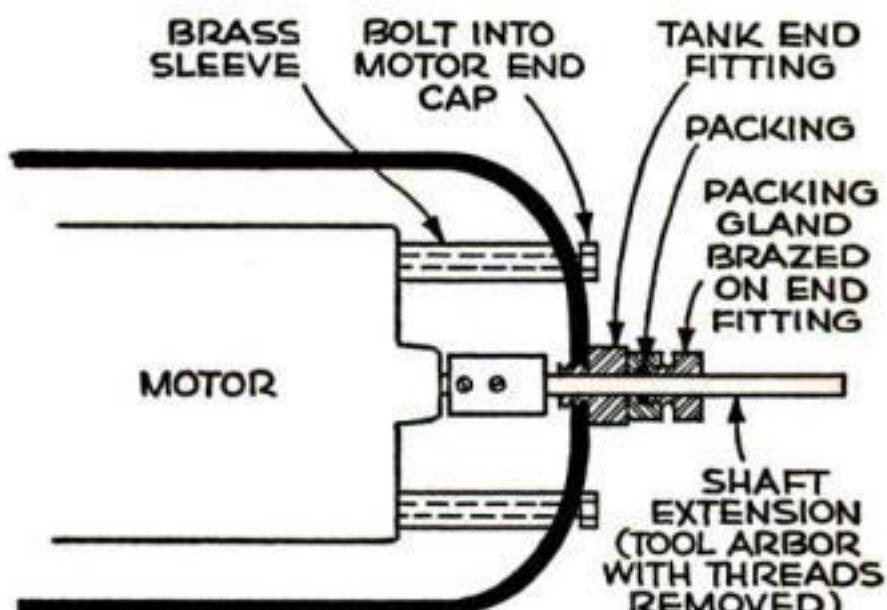


PACKING GLAND, brazed to end of tank, seals propeller shaft against leakage. Hardware-cloth guard was installed around prop, but it clogged with seaweed and could not be used.

Moving the lever up or down tilts the elevator accordingly. Moving it left or right operates the rudder. Both controls can be operated together by moving the lever diagonally, so that the scooter can be steered at the same time that it's climbing or diving.

Joe holds onto the scooter with his left hand as it pulls him along. A sealed microswitch, mounted convenient to his index finger, makes it easy to start and stop the motor.

The scooter seemed just about complete when an old tank-type vacuum cleaner caught his eye. From this, he salvaged the legs and brazed them to the bottom of the scooter to support it on land.



BRASS SLEEVES and bolts longer than the original end-cap bolts hold the motor in position inside the tank. If bolts run all the way through the motor, long rods, threaded at both ends, can be used. Make the sleeves long enough to provide clearance for the tool arbor used as an extension shaft. Shaft is turned to the diameter that is required by the propeller.

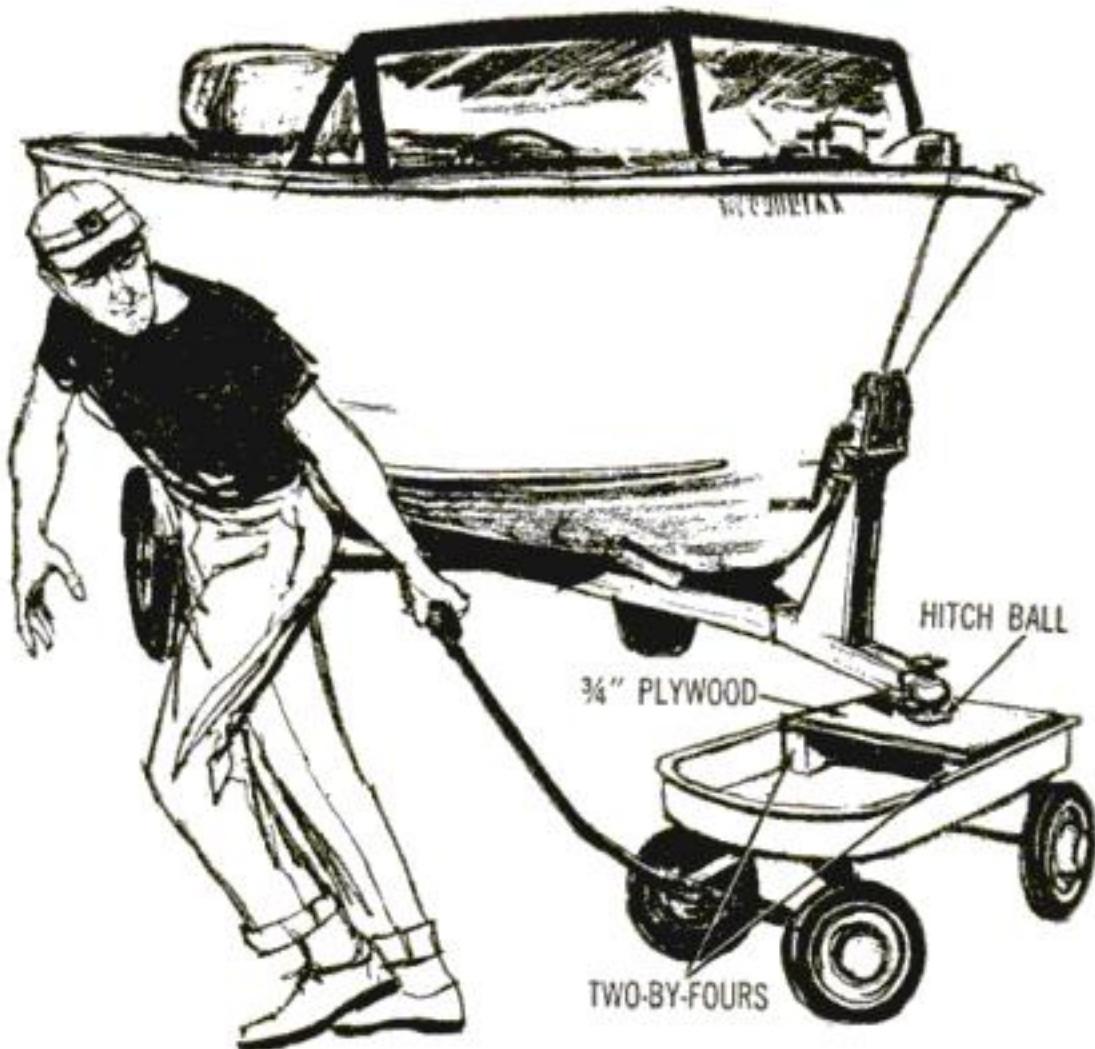
Boating Hints

By Herbert R. Pfister

Child's Wagon Pulls Boat Trailer

ANY sturdy wagon will support the weight of a properly balanced boat-trailer tongue and serve as a handy dolly for moving your boat around the yard or bringing it out to the car for towing.

Mount a hitch ball on a plywood platform supported by two short two-by-fours on edge. Place the platform in the wagon, and hitch the trailer to it.



Economical Boat Numbers

PAINT the numbers and name of your boat on plates cut from clear plastic. They can be removed so you won't have to redo the lettering each time you paint the hull. If you're poor at lettering, it will pay to have a sign painter do the job, since you can use the plates indefinitely. Use black numbers for a light-colored hull, white for a dark hull. Hull color shows through the plastic.



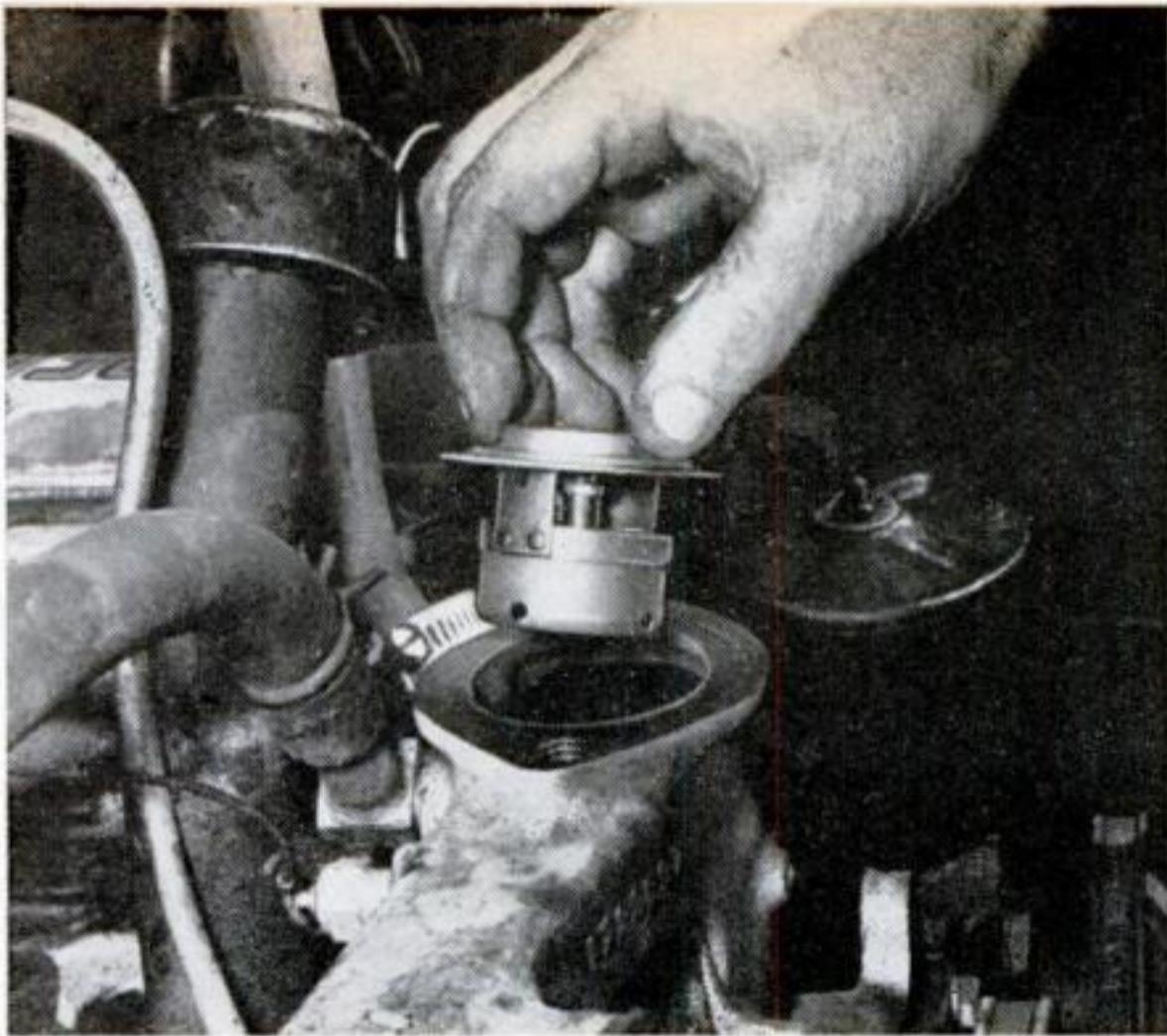
Boat Cover from Plastic Sheet

A BOAT cover that's superior in many ways to canvas can be made from black vinyl-plastic sheet. It's light, easy for one person to handle, and won't form pockets where water can accumulate and seep through into the boat.

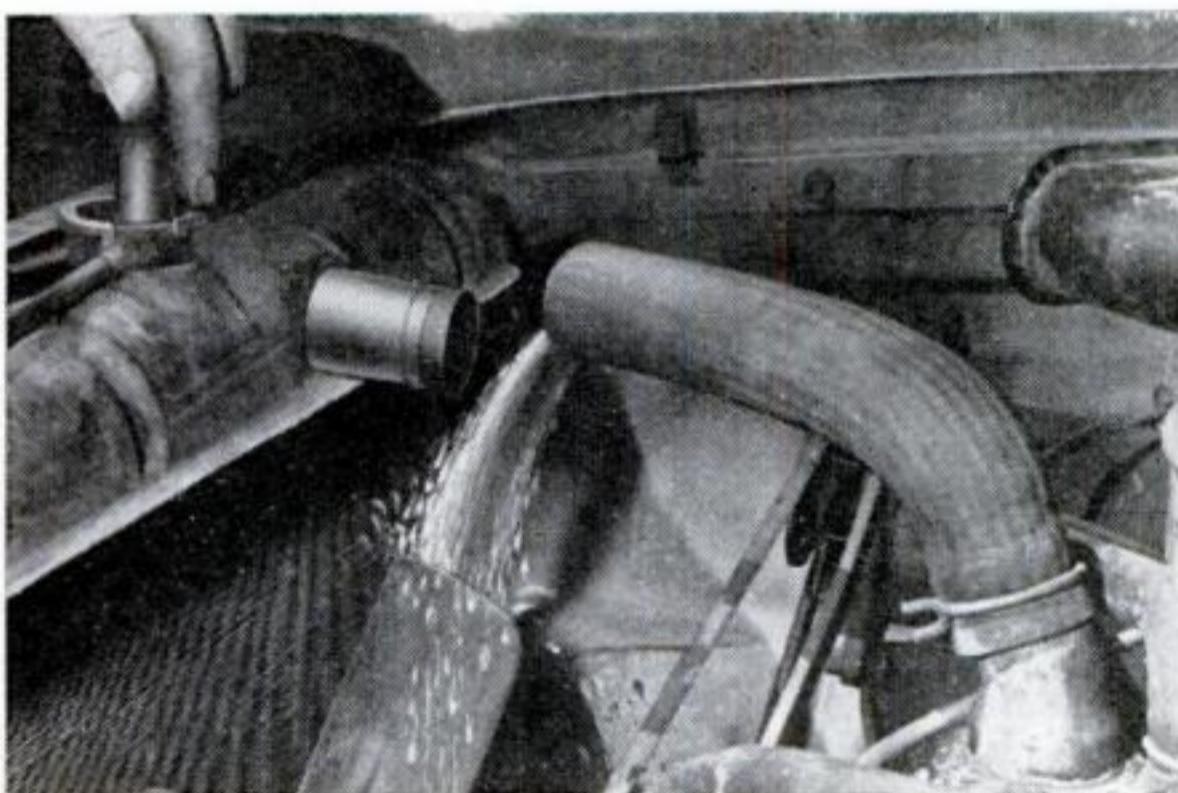
Drape the plastic over the boat and turn under a uniform edge all around. Use spring clothespins to hold the edge while you install small grommets with one of the inexpensive grommet tools you can buy in stationery, hardware, and many drug stores.

Thread Venetian-blind cord in and out of the grommets. To fasten the cover down, simply pull the cord tight and tie it at the stern, like a refrigerator-bowl cover.





UNBOLT THERMOSTAT HOUSING and remove the thermostat. Put the housing back in place, but don't connect hose to radiator.



PLUG UP CONNECTION FROM RADIATOR and run water in filler neck. Water will run through engine and out radiator hose.

Reflective Sign from Glass Chips

ANY sign or nameplate can be made to reflect light by using particles of glass. Chisel or rout the letters in a board and pour a thick layer of waterproof glue into the grooves. Wrap glass in a heavy cloth to crush it safely into fragments $\frac{1}{4}$ " or smaller. Use any scrap glass—even a discarded food jar will do. Fill the grooves with the particles.

—Paul Corey, Sonoma, Calif.



Short Cuts and Tips

FROM PS READERS

Easy Way to Flush Your Car's Cooling System

You can do a thorough job of reverse-flushing your car's cooling system with this method, devised by Du Pont cooling-system engineers.

Disconnect the upper hose, unbolt the thermostat housing and remove the stat. Bolt the housing back in place, but don't connect the hose. Instead, plug the upper radiator-hose nipple with a large cork or tightly wadded rag. Place the garden hose in the filler neck and turn the water on at a moderate rate.

The water will flow down the core, through the lower hose and into the engine, up around the block, and out through the disconnected upper hose.

When the water runs clear from the upper hose, stop flushing. Re-install the thermostat and connect the hose to the radiator. Add a good rust inhibitor and additional water to fill the radiator, and you're set for the summer.

Setting up is easier than rigging a tent

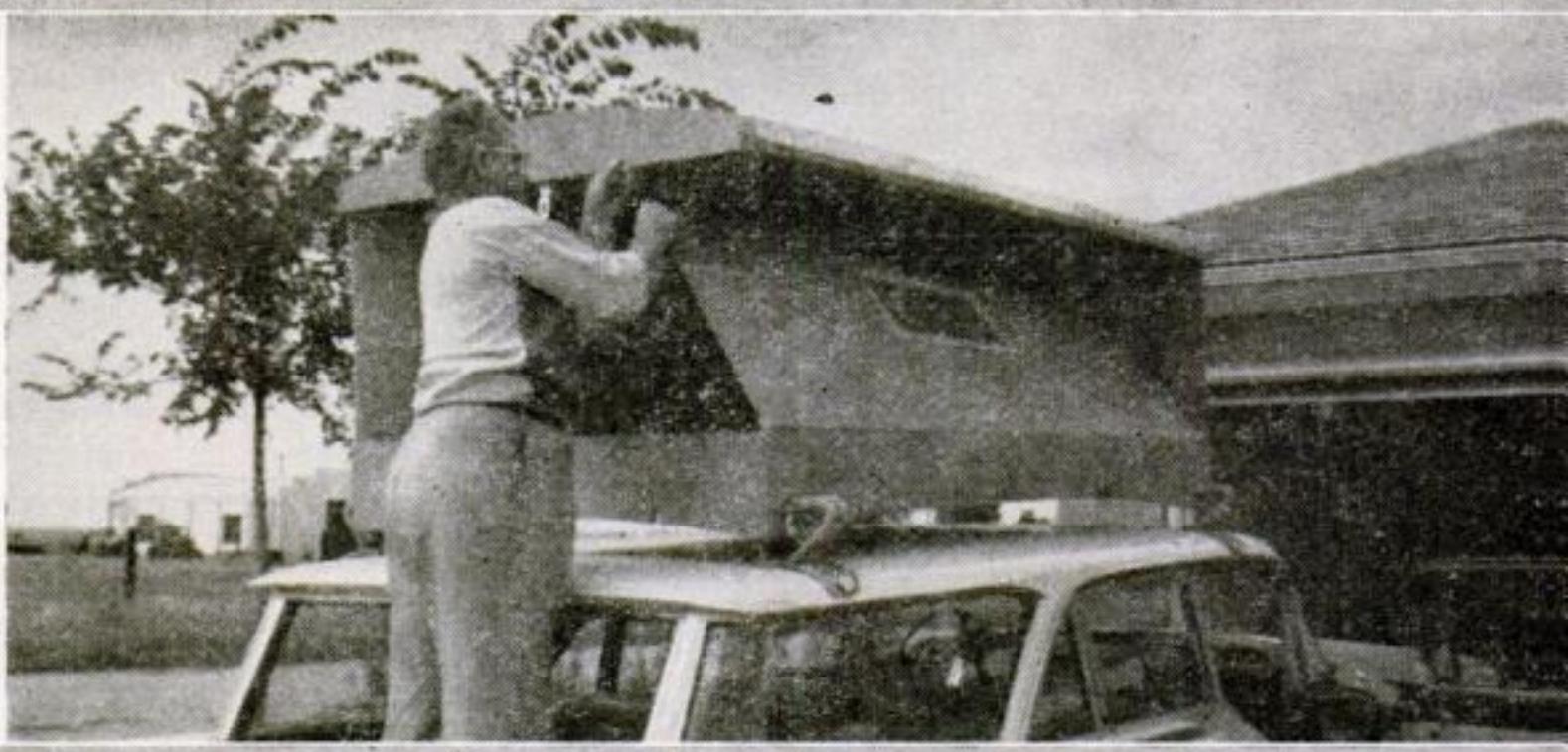
SLEEPER CABIN folds into compact roof-top load that offers little wind resistance. Since it shades most of the roof from the sun, the wagon is cooler inside by quite a few degrees.



A ONE MAN JOB, setting up starts with raising the front of the roof so that the front end can drop down. The end is then fastened with wingnuts on two bolts in the base.



LIFTING THE ROOF at the rear and swinging the hinged sides up to support it is the next step. With solid footing on the tailgate of the wagon, both hands are left free to work.



DOOR FRAME UNHOOKS from underside of roof and drops into position between the sides, squaring and bracing them. Bottom edge of the door frame is locked to inside of the base.



Station-Wagon Penthouse Sleeps Two

By Herbert R. Miller

SNAKES, crawling insects, or puddles of rain can't slip under the covers with you while you're sleeping in this roof-top cabin designed for station wagons.

Besides keeping you well off the ground, the collapsible cabin more than doubles the shelter area of a station wagon. Two people can sleep in the rear of the wagon, while two others bunk on top of it. If the wagon is filled with hunting and fishing gear, two campers can sleep in the cabin, leaving the gear locked inside the car.

The cabin is built on a 4'-by-8' base of $\frac{1}{4}$ " exterior-grade plywood. This provides ample room for a 4'-by-6' mattress or two single inflatable mattresses. Two pillows, blankets, and the entry ladder can be stored in the extra 2' when the cabin is folded.

How it's built. Two sturdy car top carrier bars and four oak crossbraces bolted to the underside of the floor stiffen the thin plywood. Cut and dado the frame sides and ends to fit around the floor, and glue and nail them in place. Note that the frame is curved at the bottom to conform to the roof contour. The curve isn't necessary, but it gives a more pleasing appearance.

The cabin sides are installed next. Cut from $\frac{1}{4}$ " exterior plywood, they are



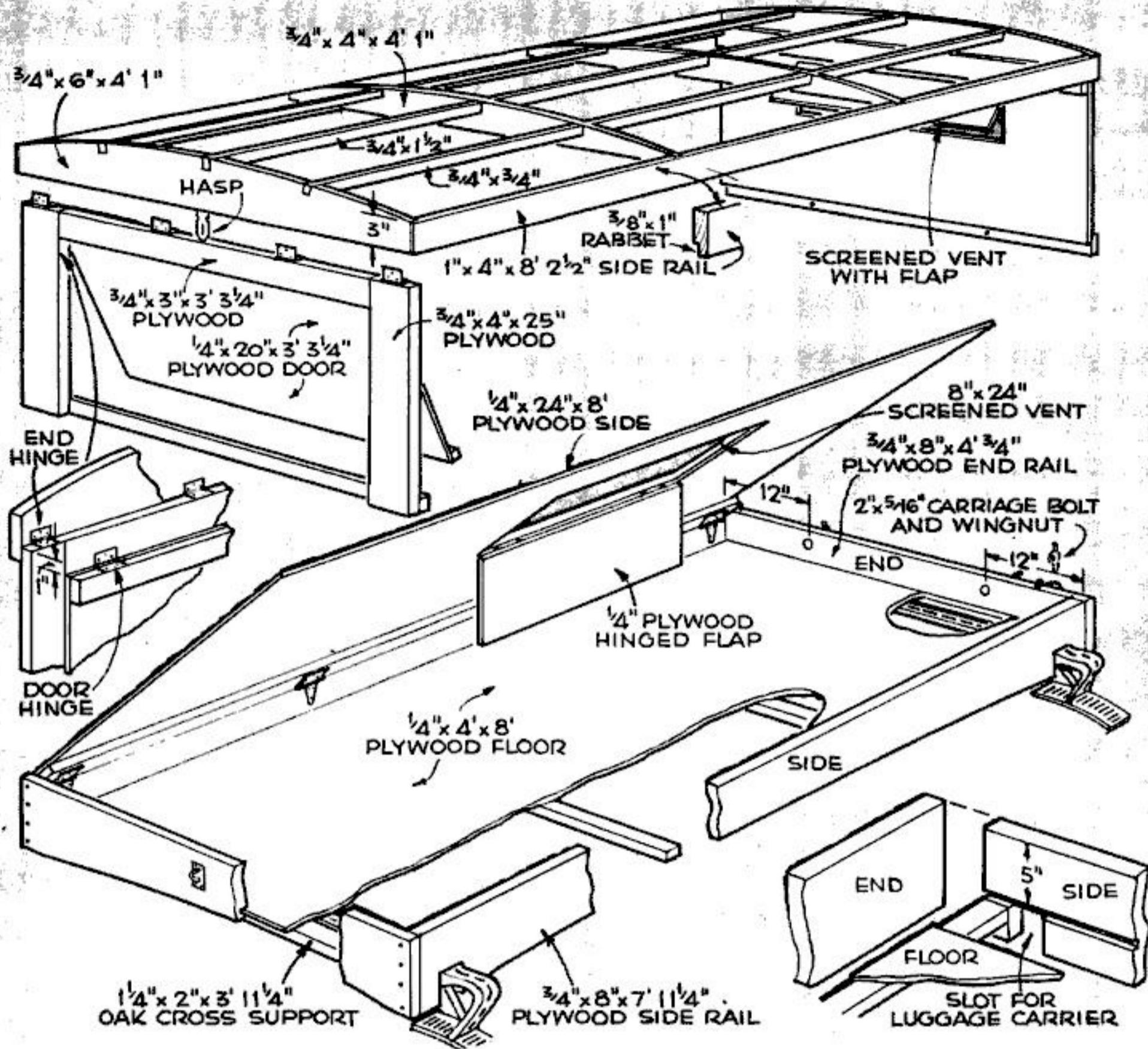
Designed to fit any make of wagon, this collapsible car-top sleeping cabin can be built for about \$40

fitted with a thickener strip along the bottom edge to bring them flush with the base on the outside when mounted on their T hinges. Cut an 8"-by-24" opening in each side and cover the openings with plastic screening, retained by a light frame. Hinge the pieces cut out so they can be used to close the openings against night breezes or rain.

Fold the sides into the base and assemble the roof framework to overlap the base frame 1". Strive for a good fit

CONTINUED

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here as wind will drive rain into any gap between the roof and base when you drive at high speeds with the cabin folded. Cover the roof with a 4 1/2'-by-8 1/2' sheet of light-gauge aluminum. Fold the edges over and tack securely.

To fasten the roof, set two 5/16"-by-2" carriage bolts permanently in the front end of the base frame. Drill matching holes in the roof frame to slip over the bolts. Use wingnuts to fasten this end. At the rear, install a hasp and padlock. To separate the roof from the base, lift the hasp end and slide the roof forward and off the bolts.

How it goes together. Unfold the sides and brace them temporarily so they'll support the roof while you fit and install the ends. The front end, like the sides,

is 1/4" plywood with a screened vent. Hinge it to the inside of the front roof frame, 1" up from the bottom edge. This lets the roof overlap the base 1" when the end is folded inward. Fasten a 3/4"-by-2" plywood strip along the bottom edge and drill holes to match the bolts in the front of the base. These same bolts and wingnuts will hold the cabin end erect.

The rear end is a doorway of 3/4" plywood, also hinged 1" from the bottom edge of the rear roof frame. A solid door of 3/4" plywood is hinged to the top of the doorway so the cabin can be closed completely. A turn button inside locks the bottom edge of the door shut. Finish with one or two coats of plywood sealer followed by a coat of exterior paint.



Short Cuts and Tips

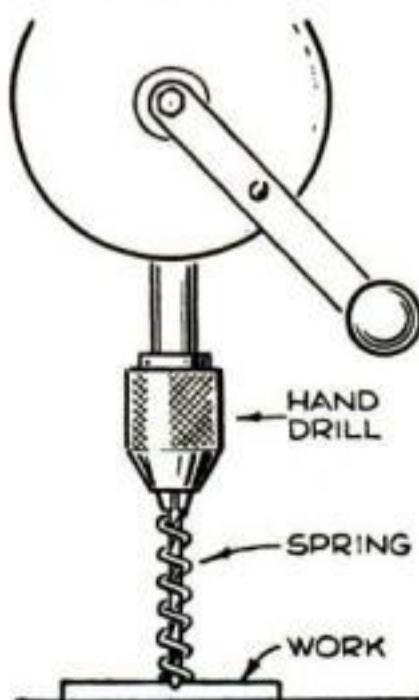
FROM PS READERS

Back-Seat Carpets Dress Up a Car

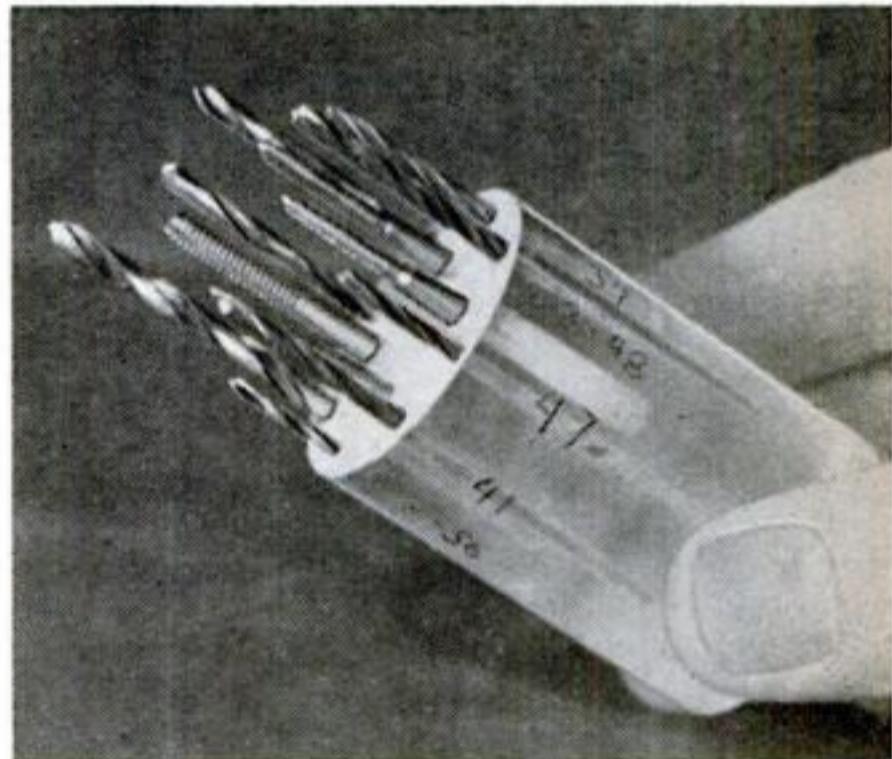
FLOOR wells in the rear compartments of many cars can be fitted with individual carpet squares. They add a note of luxury and are easily removed for cleaning and drying. Carpet shops can supply remnants or outdated samples at very low cost. Cut these to the right size and have the shop bind the edges. Or you can merely coat the back and edges with liquid rubber to keep them from unraveling and skidproof them.—*Walter E. Burton, Akron, Ohio.*

►►►WE'VE used all kinds of abrasives on our woodwork. But papers don't fit baseboard curves and steel wool is messy. So we tried a plastic scouring sponge my wife had been using in the kitchen. The pad has a coarse coating on one side (ours is from Scrubbee Products, Newark, N. J.) that makes quick work of smoothing both pine and oak. It adapts to all contours, raises very little dust. When the abrasive coating fills, it's easy to tap clean. When it wears too much for wood, we use it to buff varnish.—*Donald M. Feurt, Oroville, Calif.*

Spring Reduces Drill Breakage



A COIL spring slipped over a small drill will greatly reduce the amount of breakage common when tiny bits are used in a hand drill. The spring helps to keep a uniform pressure on the drill and cushions the drill when it breaks through the hole.—*F. Murray, Chicago.*



Holder for Drills and Taps

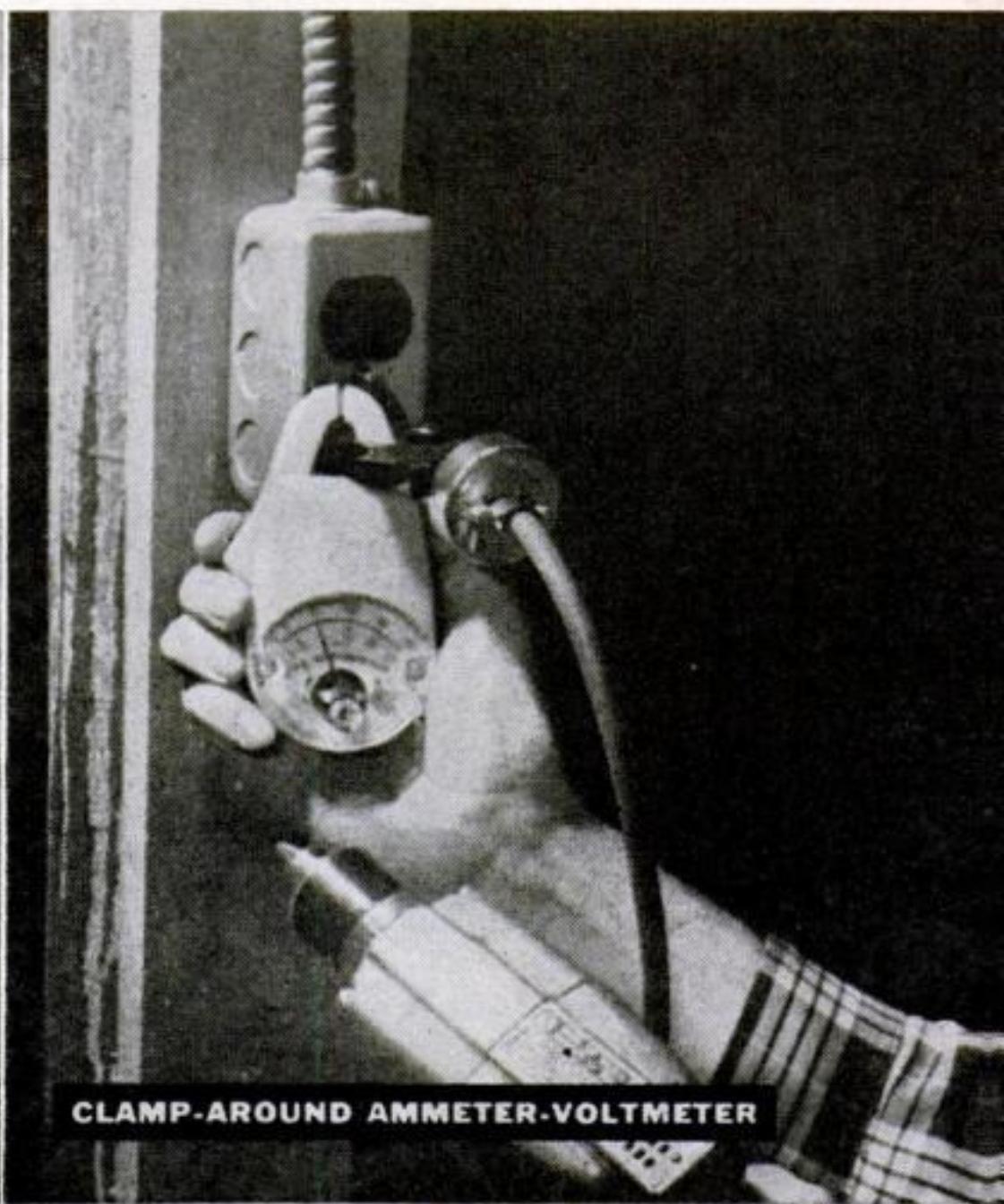
THIS holder for taps, tap drills, and clearance drills ends the chore of consulting tables for tapping sizes and puts the right drill at your fingertips. Drill holes in a wood or plastic block to receive the taps and drills. Arrange the holes in triangular clusters of three—tap, tap drill, and clearance drill.

I've found it a good idea to countersink the holes slightly to aid in inserting the bits. Cross-drill a tiny hole at the bottom of each to allow air to escape so the drills can be inserted or removed easily.—*Joseph Tartas, Haskell, N. J.*

How You Can Save



MULTIMETER



CLAMP-AROUND AMMETER-VOLTMETER

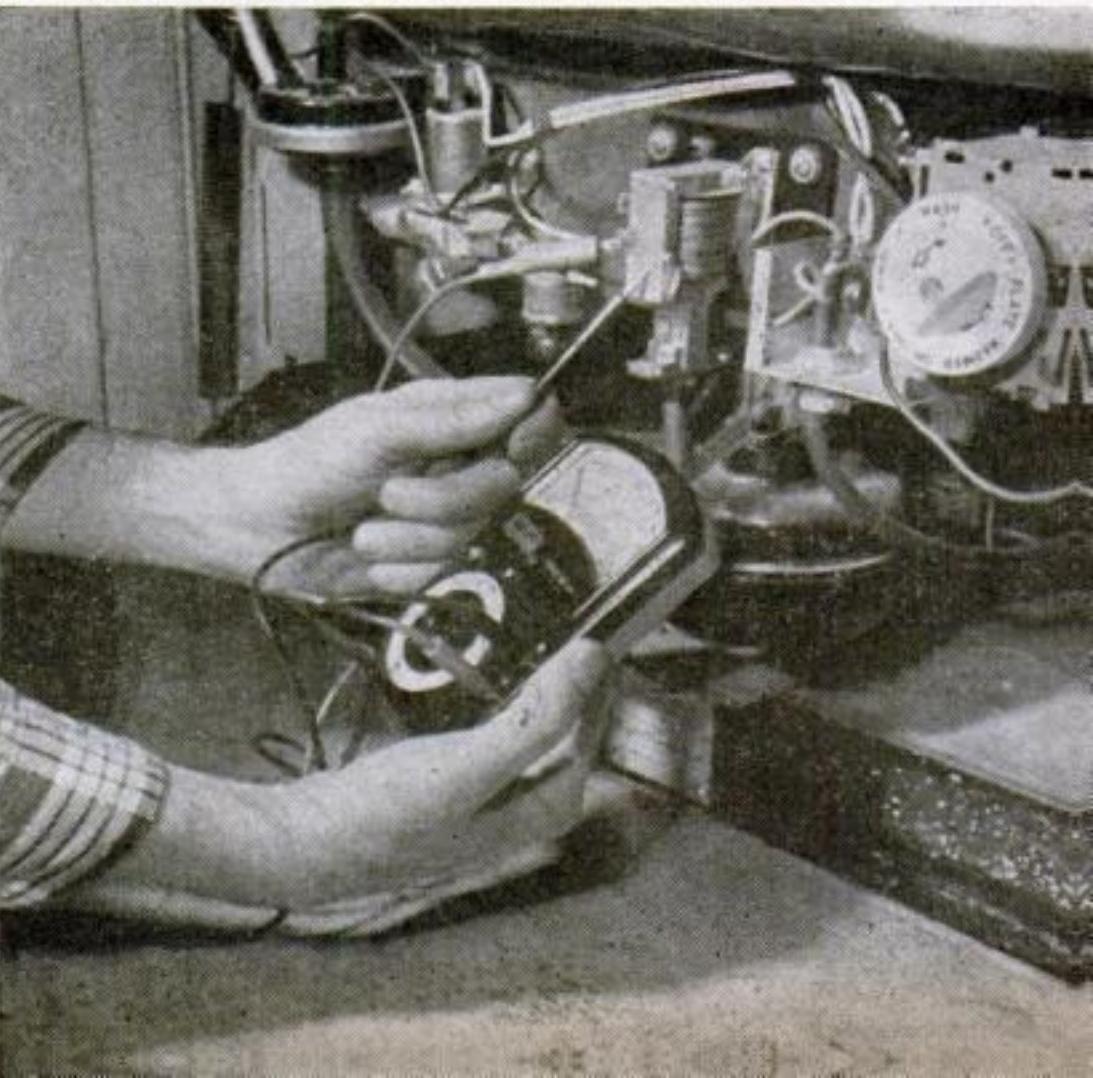
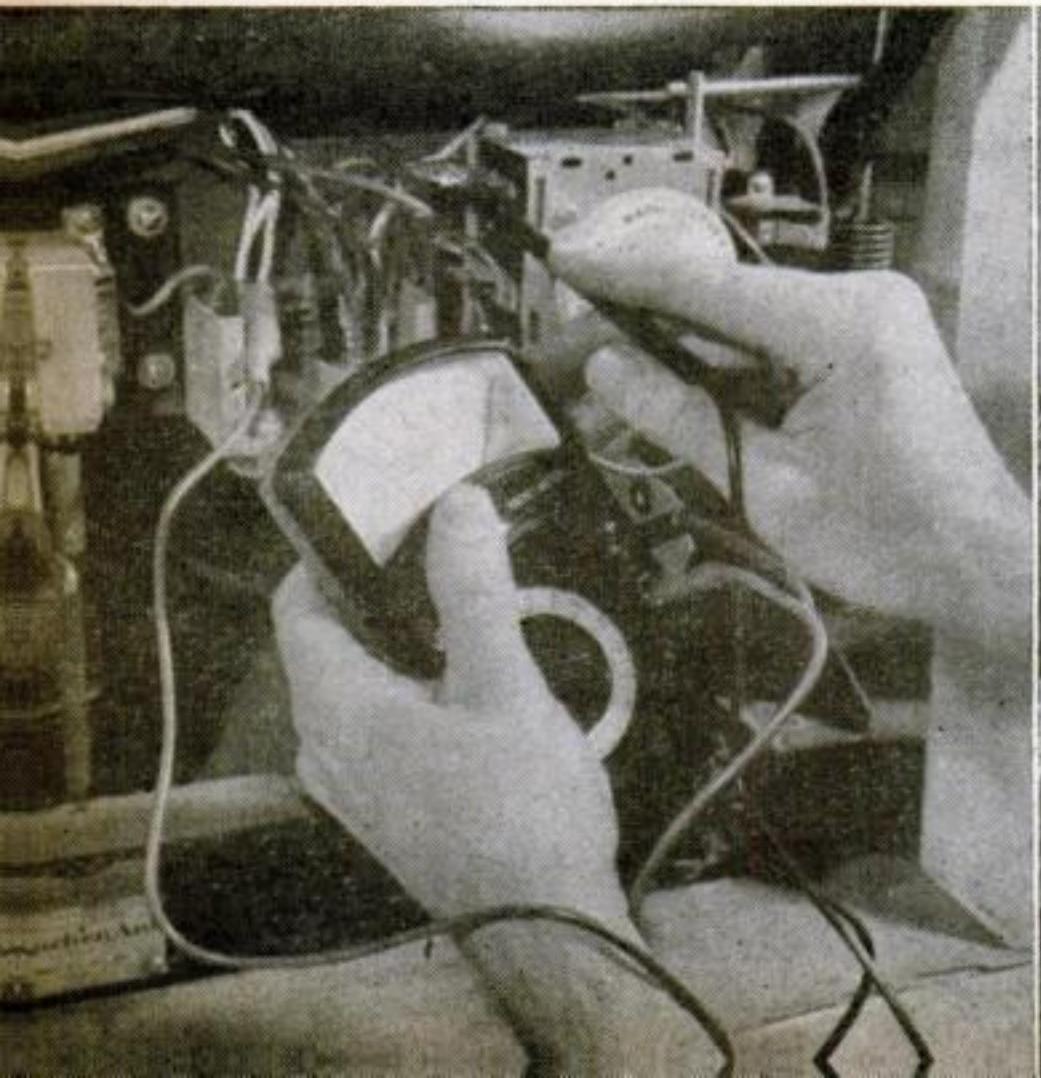
PROPERLY GROUNDED SYSTEM shows full line voltage between "hot" side and metal outlet box.

MEASURING CURRENT DRAW of a motor can often warn of trouble before it becomes serious.

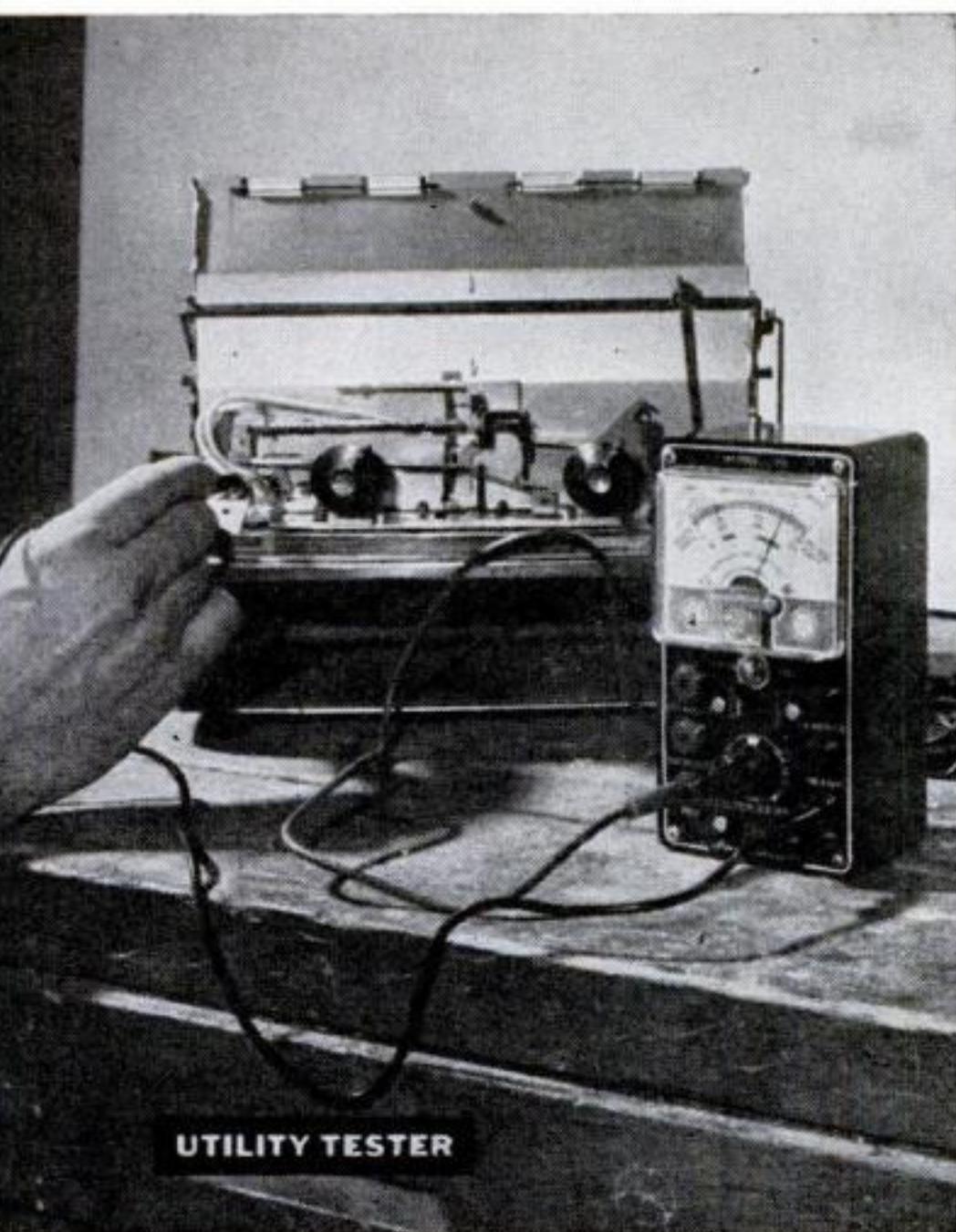
Here's how to use a multimeter in tracking down electrical

VOLTAGE CHECK at timer switch will show which terminals get juice for each phase of the cycle. Clip one lead to the common terminal; touch the other to each timer connection.

ABILITY TO MEASURE HIGHER RESISTANCES makes multimeter useful for checking insulation resistance or partial grounds. Clip one ohmmeter lead to terminal; touch other to metal frame.



with a Test Meter

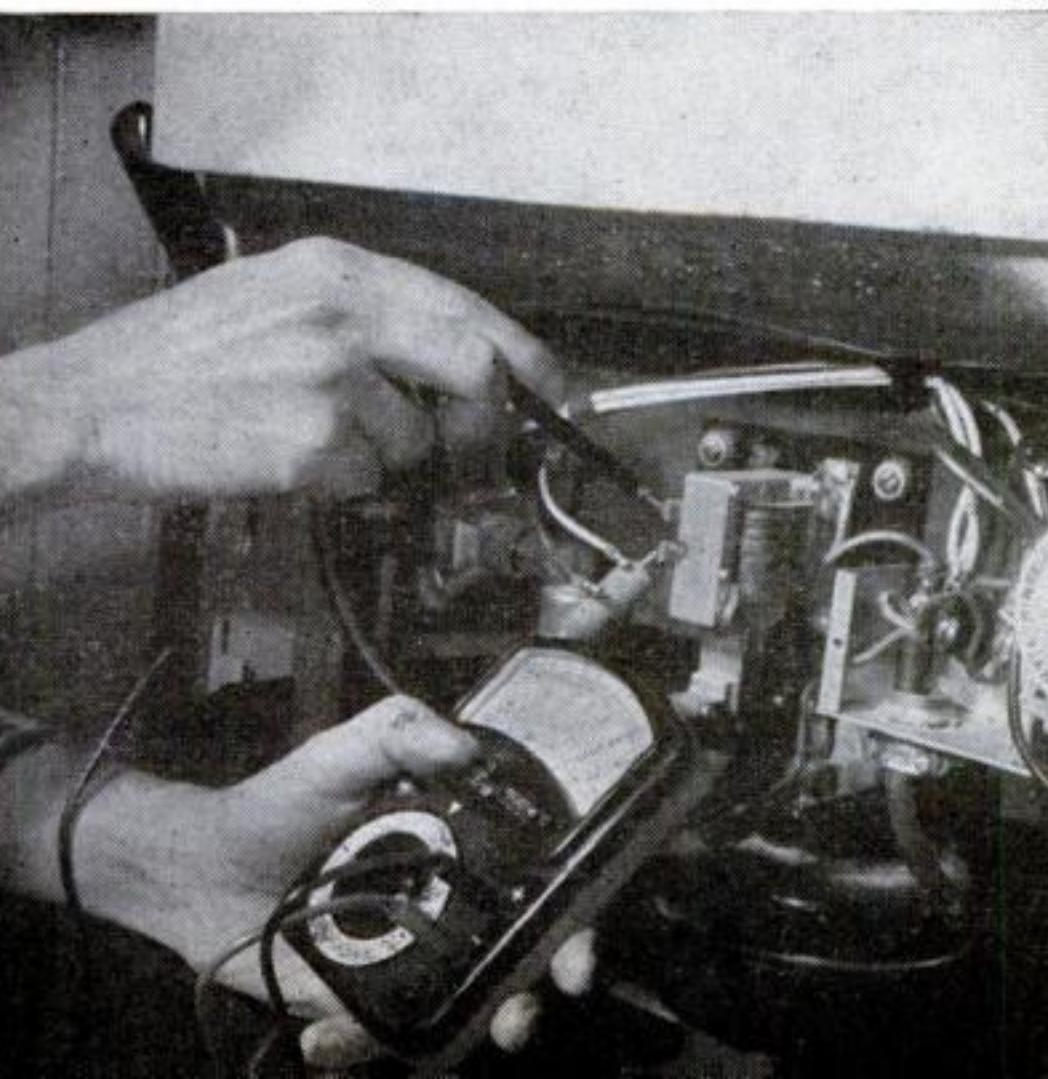


UTILITY TESTER

DEFECTIVE PARTS can be isolated by tracing through circuit of toaster with an ohmmeter.

faults in an automatic dishwasher

SWITCH TO LOW OHMMETER RANGE to check resistance of solenoid winding. Disconnect solenoid wires. Touch test leads to coil terminals. No reading? There's a break in coil winding.



Persecuted by balky electrical servants? You can keep them on the job, save on costly repairs, and have fun doing it with a low-cost test instrument

By Hubert Luckett

WHAT do you do when your automatic washer quits in the middle of a load of vitally needed diapers? If you're like most home owners, you'll remove the back, peer at the innards, jiggle a few wires, kick it hopefully a couple of times, then sit back and stare bleakly at the nest of wires, switches, solenoids, and motor—hoping the trouble will identify itself.

But the guilty parts are seldom so obliging. Without a test meter to finger the invisible volts, amps, and ohms, you'll rarely get a confession. Even with faults that might yield to patient probing and parts substitution, a meter can save time, and often the cost of parts that proved to be unneeded.

Do you need a lot of electrical savvy to make a meter worth while? Not at all. If you know enough to pull the fuse before you replace a faulty light switch, you can put a meter to work, following the procedures outlined later.

What kind of meter should you buy? The answer depends on whether your interests go beyond appliance repair. Each meter has its advantages for a particular kind of work. Here are the types to choose from:

- Multimeters, familiarly called VOMs, from *volt-ohm-meters*. The workhorse in radio and TV repair shops for years, they've been expensive in the past. But now you can get a satisfactory Japanese import for as little as \$10.
- Utility testers. Specifically tailored for home-grown electricians, these are available by mail order for around \$16.
- Clamp-around ammeter-voltmeters. These favorites of professional electricians have just become available in a version for the home owner at about \$20.

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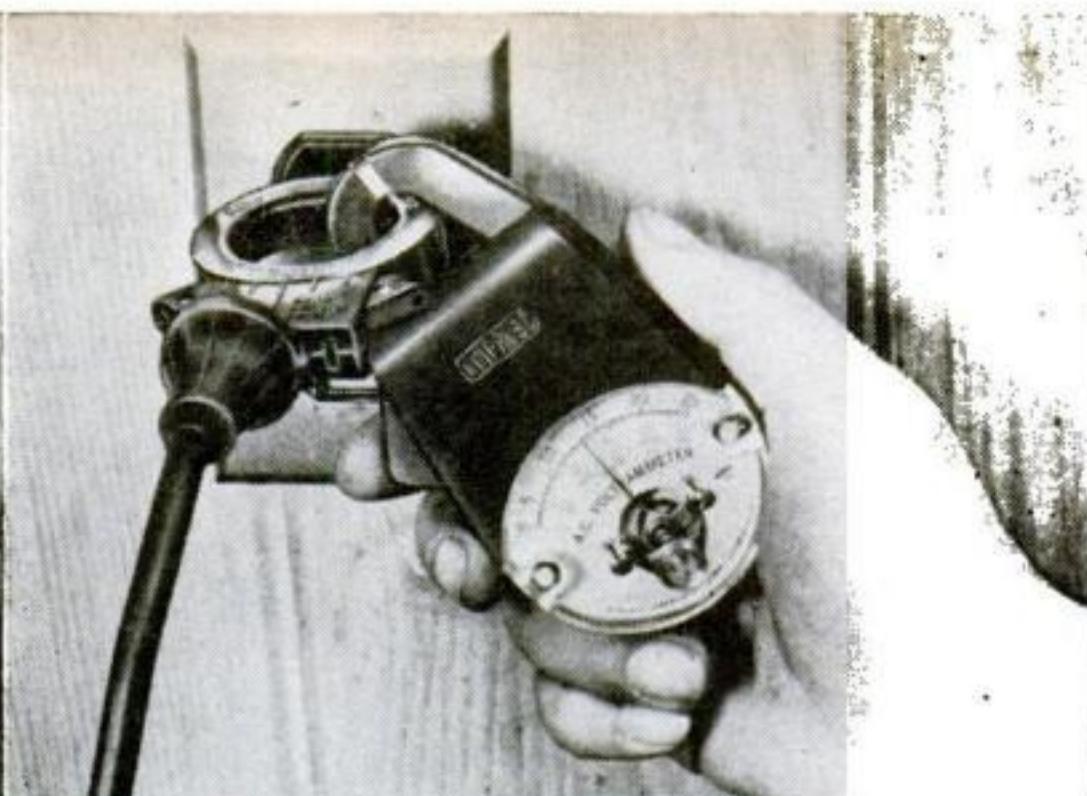
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New version of clamp-around ammeter-voltmeter makes a pro's



MEASURING CIRCUIT LOADS is easiest with a clamp-around ammeter-voltmeter. No need to open the circuit—simply clamp it around a single circuit conductor and read current.

The multimeter. If you're an electrical experimenter, radio bug, or model-train fan, your best bet is probably a multimeter. It will cover all the voltage ranges, both AC and DC, that you're likely to need, as well as some you'll probably never use. It has an ohmmeter for continuity and resistance checks. Its main shortcoming is the limited range of the ammeter. Usually it won't handle more than one amp, making it useless for meas-

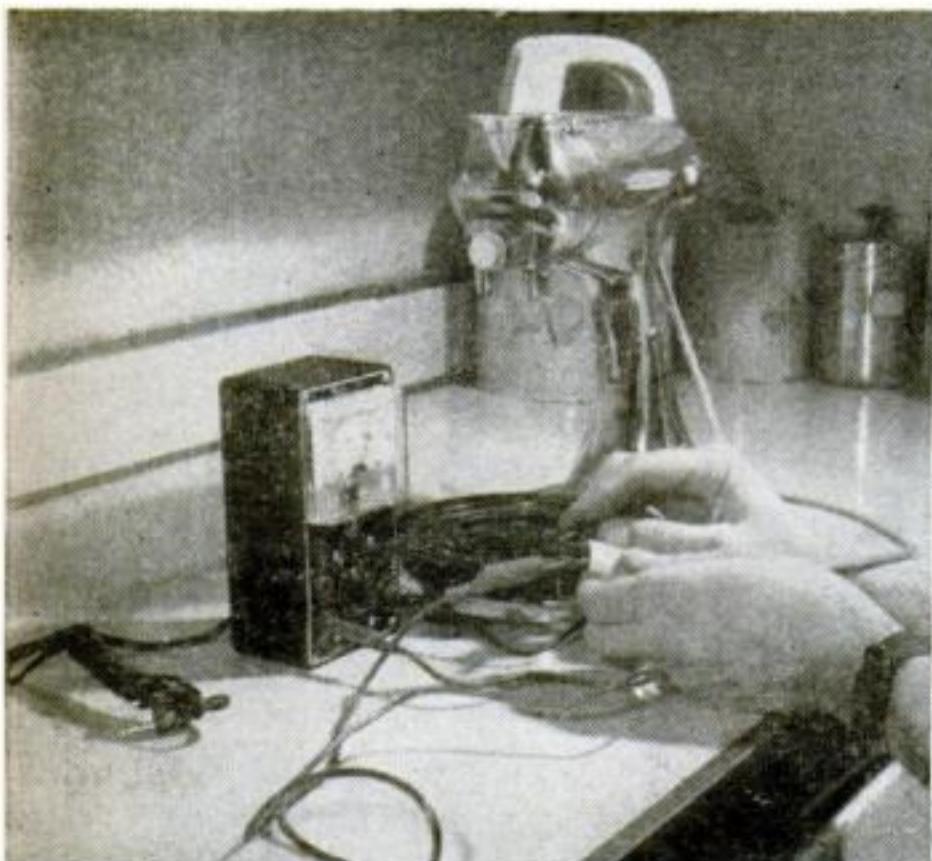


CURRENT DRAW of plug-in appliance can be measured without going into internal wiring by using accessory energizer. Plugged in one way, meter sensitivity is multiplied by 10.

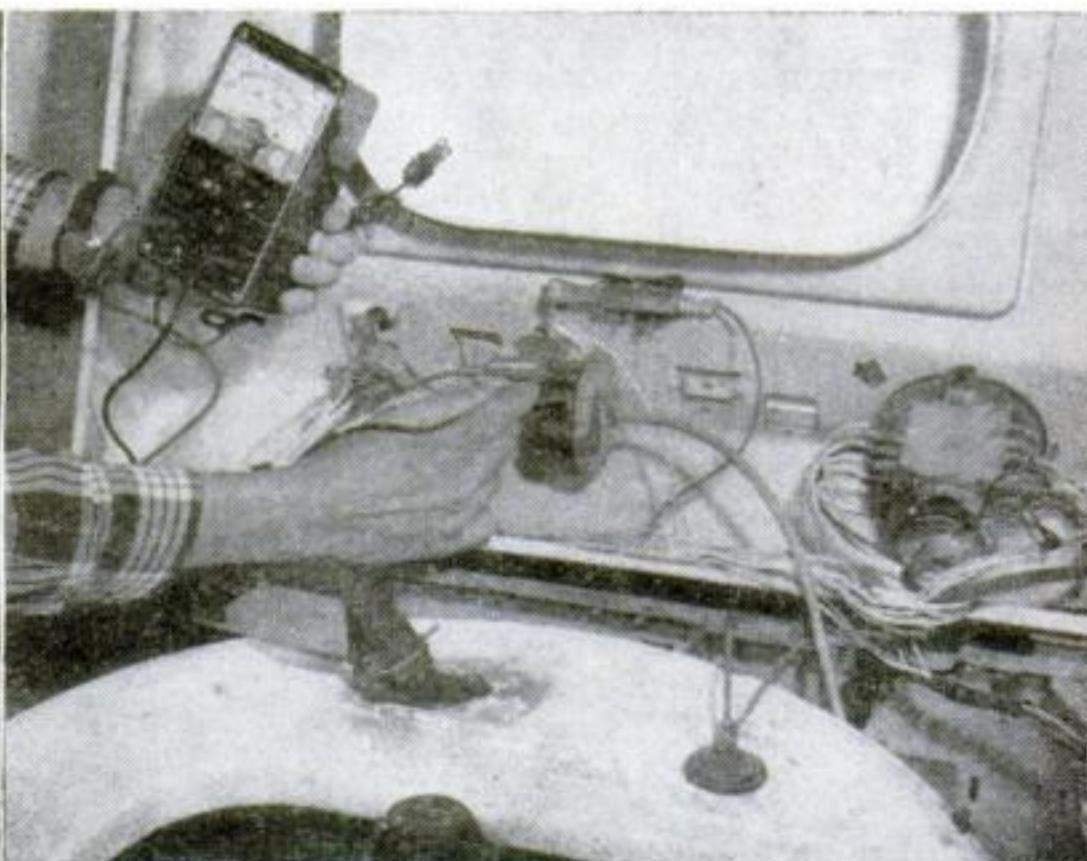
uring current draw of most appliances.

The utility tester. This will appeal to the home owner whose main interest is keeping a pushbutton household running smoothly. You can check the current consumed by an appliance simply by plugging it into the receptacle on the front of the instrument. It measures up to 15 amps. There are only two voltage scales to contend with when working on household equipment—one for 115-volt lines

Utility tester is a simplified household meter that can also be

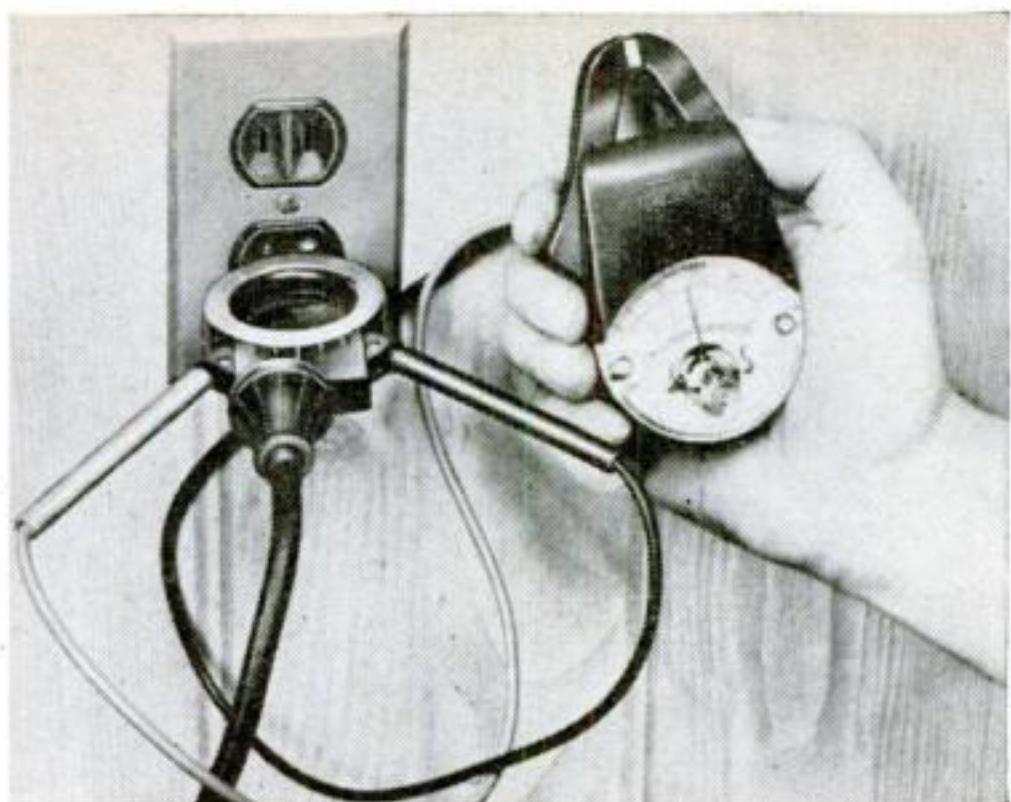


OHMMETER FUNCTION of the utility tester is used here to measure motor resistance. Touch test leads to prongs of plug. Normal resistance for this type motor will read about 10 ohms.



CHECK ELECTRICAL CONTINUITY through wiring and switches of an automatic with the ohmmeter. Self-contained battery supplies juice for this test, so meter is not plugged into outlet.

tester available to home owners



LINE VOLTAGE can be conveniently measured at the outlet while appliance is operating. Voltmeter leads are plugged into pin jacks provided on each side of the energizer.

and one for 230-volt lines. There's also a switch-selected range for car-battery voltages. The ohmmeter uses a self-contained battery and measures resistances from about 2 to 1,000 ohms.

Clamp-around ammeter-voltmeter. For the home owner who takes his electrical work seriously, it's hard to beat this device. You can measure current without touching the live circuit—it works by induction. Of course, it's for AC

used for auto electric systems



MEASURE CURRENT consumed by an appliance with tester cord plugged into outlet and appliance cord plugged into tester. If current is above normal, look for dirt clogging impeller.

only. Essentially it's a split-core transformer. The external part of the core opens, alligator fashion, to encircle a wire. The current-carrying wire becomes the primary of a transformer while the secondary is internally connected to the meter which reads amps directly. There are a pair of jacks to receive test leads for measuring voltage with the same meter. An accessory "energizer" plugs into an outlet and you plug an appliance into it for convenience in measuring current or voltage while the device is operating.

After you've mulled over the pros and cons of the various instruments and decided which is best for you, don't wait for an emergency—buy now before you have trouble. Besides giving you a chance to get acquainted with a fascinating new tool when you're not under pressure, there are solid arguments for this (if you need support to get budget priority):

- The secret of rapid, efficient troubleshooting is knowing what the voltage, current, and resistance readings should be when the appliance is working right.
- Regular checks of resistance and current draw can tip you off to impending troubles before they get serious.
- A meter survey of your house wiring may turn up unsuspected conditions that could lead to equipment failures.

Learning to use your meter. Study the instructions for your new meter until you're sure you know how to set the instrument for each range and function before you try it on a live circuit. A mistake here can damage the meter. If you are uncertain about a voltage you want to measure, always try the higher range first. For example: Say you want to check a 115-volt circuit in a box fed by a 3-wire, 230-volt service and your meter has a 150-volt and a 300-volt scale. Use the 300-volt scale to identify the 120-volt circuit; then switch to the 150-volt scale.

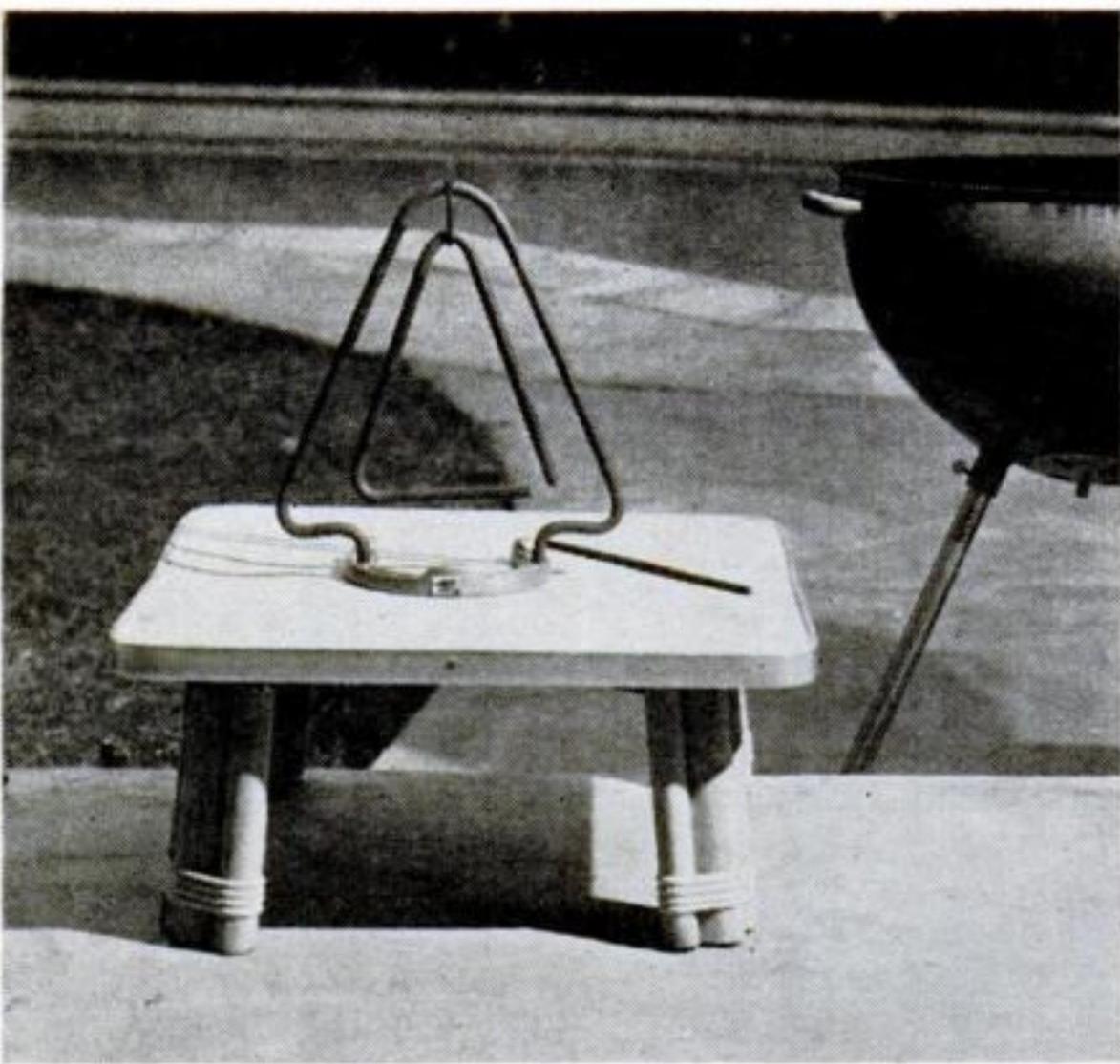
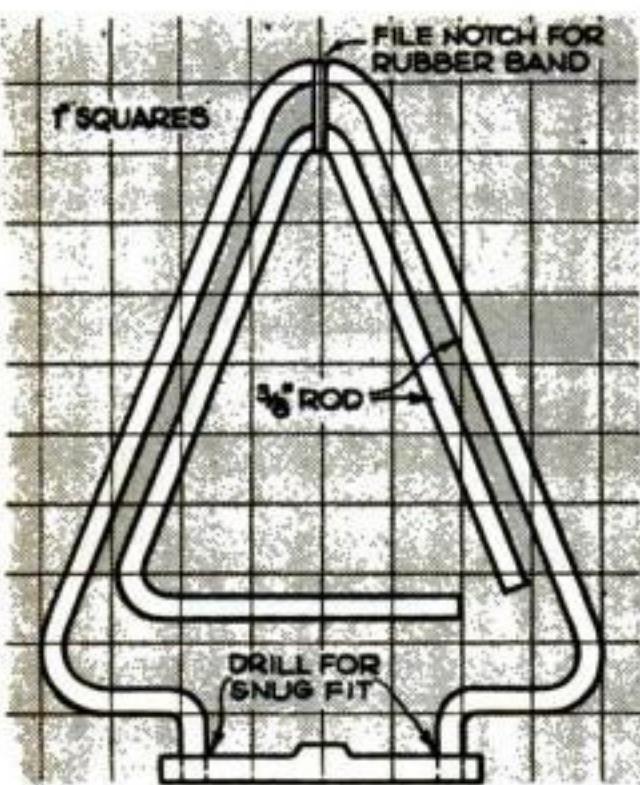
Remember that voltages are measured across the line, one probe on each conductor. Current is measured by opening the circuit and inserting the meter in series with the load, unless you have the clamp-around ammeter. Resistance measurements, commonly across part of a circuit, should never be attempted without first unplugging the equipment.

Checking normal operation. Since permanent health records for all your ap-

[Continued on page 192]

Short Cuts and Tips

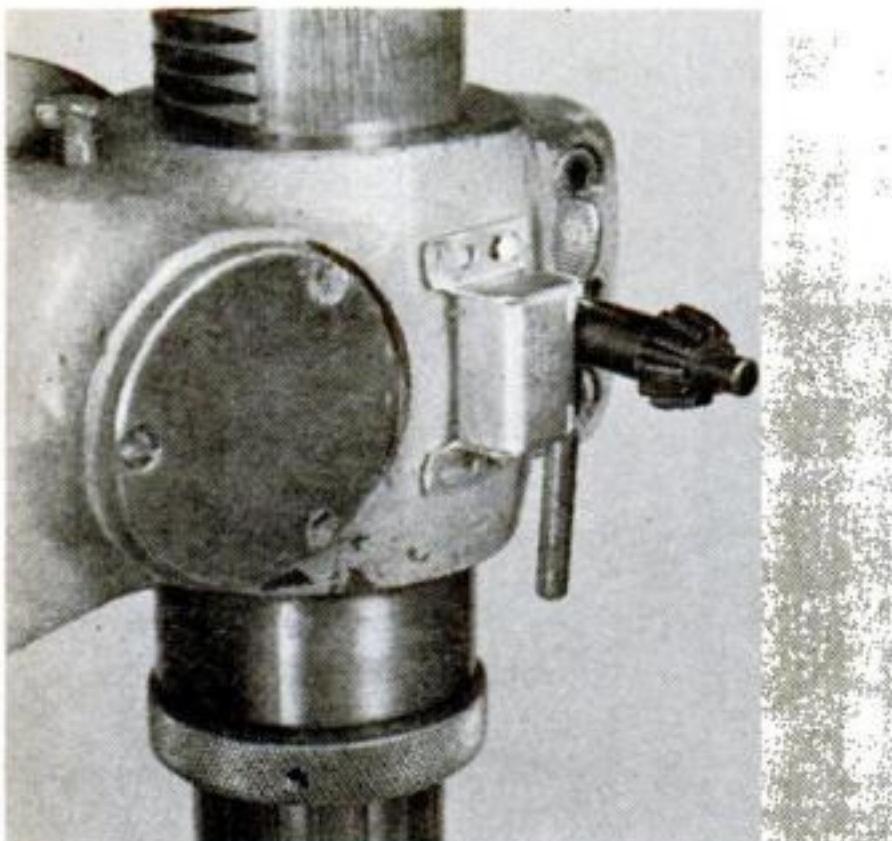
FROM PS READERS



Come-and-Get-It Gong

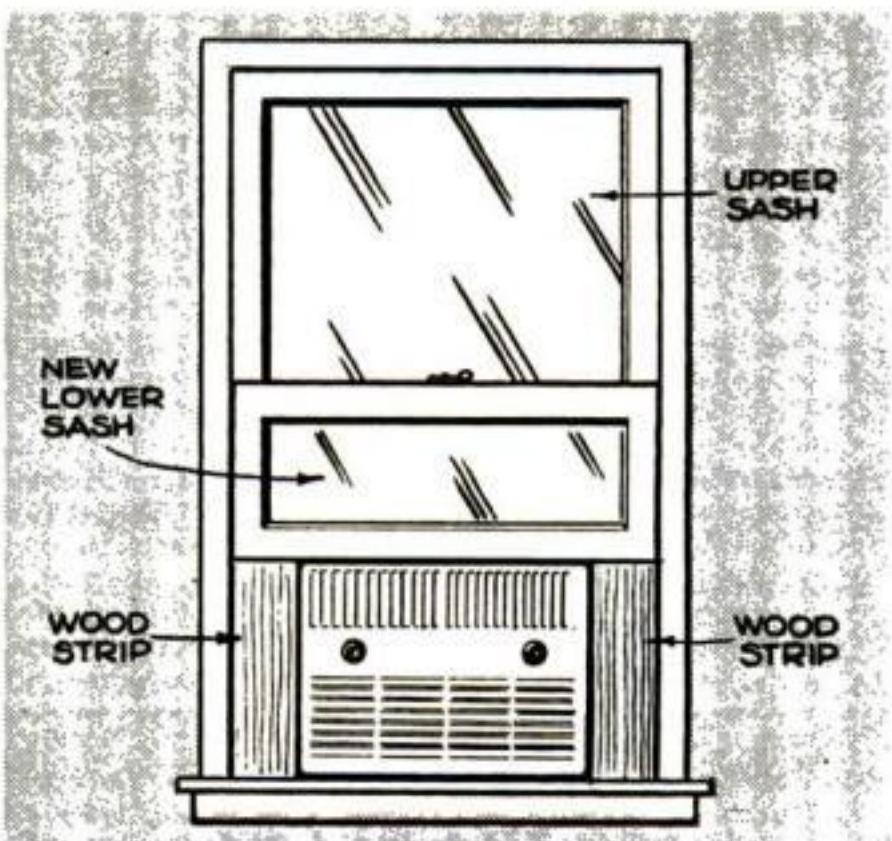
SUMMON barbecue guests with this scaled-down version of the old mess-hall gong. You'll need two rods, about 20" and 28" long. High-carbon steel gives a

good tone. Form the triangular shapes and hang one inside the other on a rubber band. A horseshoe makes a good base. A third rod serves as the hammer. The photo above is from the Rickhoff Glass Co., Norco, Calif.



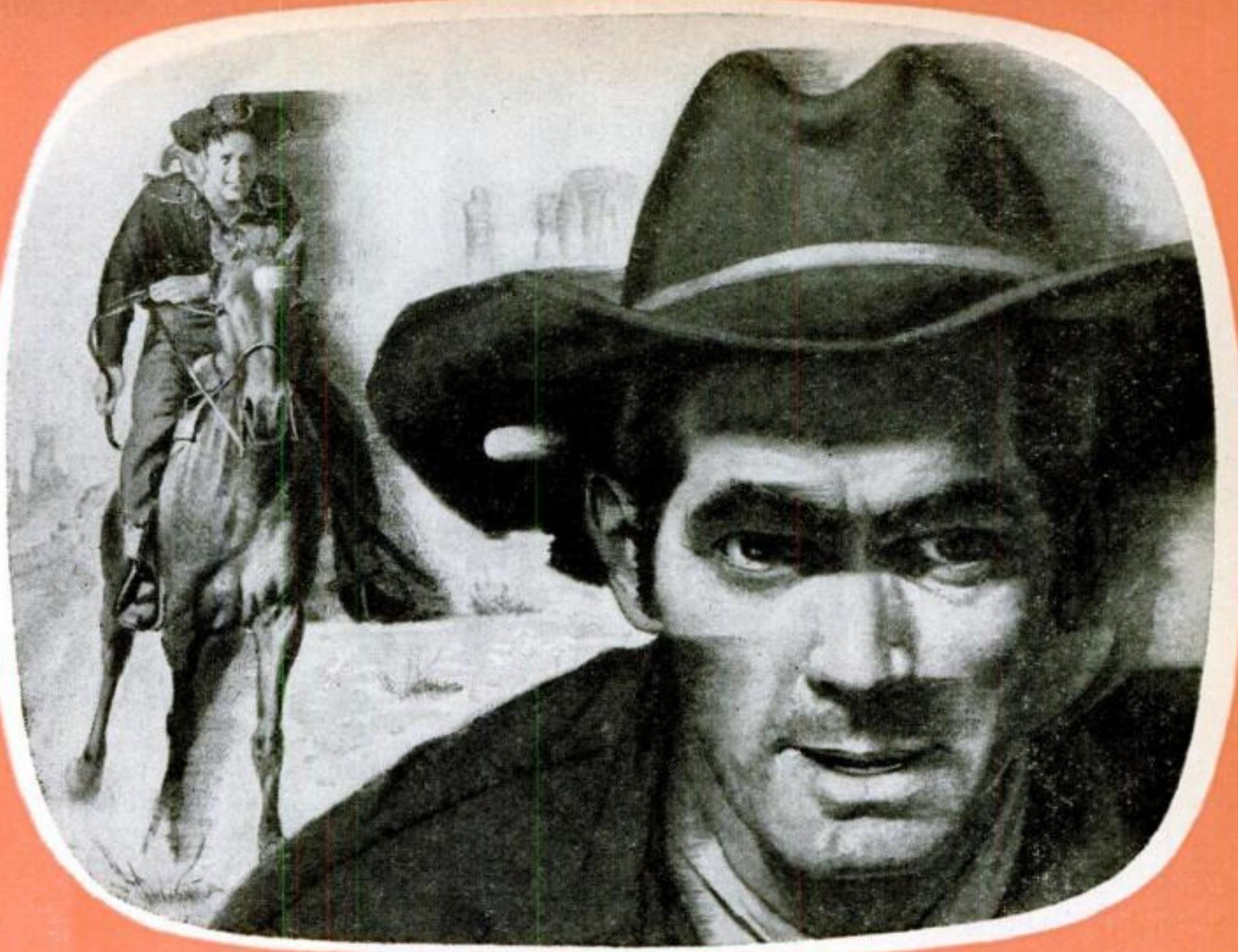
Magnetic Chuck-Key Holder

A MAGNETIC cabinet latch makes an excellent chuck-key holder for the drill press. The chuck key is always at hand and there is no troublesome chain to wind around the key when you turn it. Fasten the latch in any convenient location on the drill-press head by drilling and tapping for two small machine screws. —H. J. Gerber, Stillwater, Okla.



Mounting an Air Conditioner

INSTALLING an air conditioner by simply raising a window sash has two drawbacks. You can't clean the glass easily, and it's hard to get a good seal at the top of the inner sash. As a solution, I had a carpenter make a new short lower sash to fit the opening above the conditioner. Wood strips fill in at the sides.—M. G. Fisk, New Milford, N. J.



Fixing Video-Tube Troubles

By Art Margolis

The TV signal gets its final processing, in preparation for viewing, from the video tubes. If you know what to look for, your eyes are the best test equipment for diagnosing video-tube faults.

Up through the I.F. strip, the TV signal is amplified as a whole. Then it goes to the video detector, which separates the video, sound, and sync signals from the carrier. Each then follows a separate path. The video amplifier boosts the pure video signal before it is fed to the picture tube.

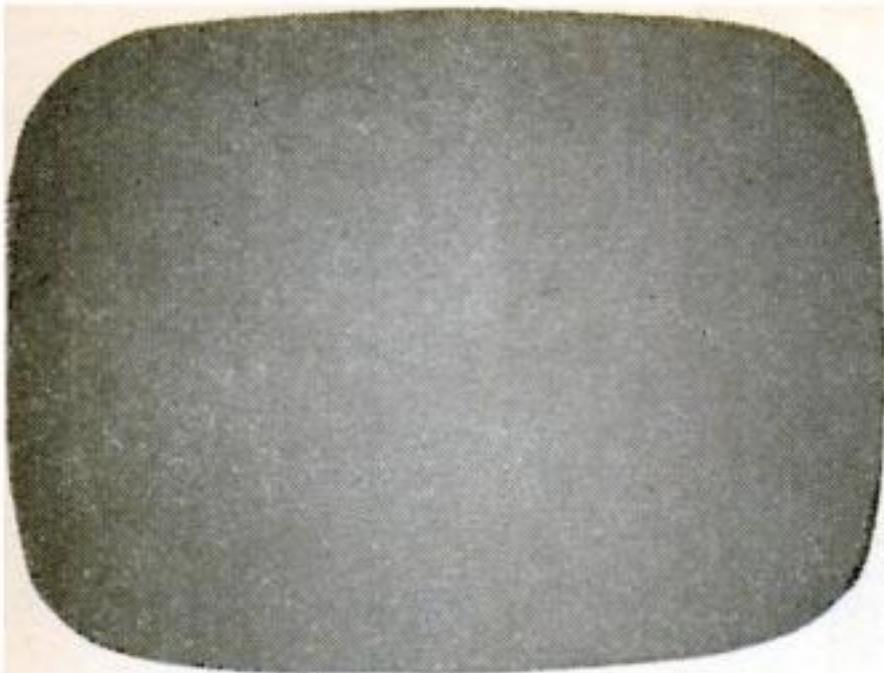
"THIS is Hank Gabian." The voice on the phone didn't go with the name until I realized it was Hank junior calling. Hank senior owns a local cocktail lounge called the Pink Elephant.

"Something funny is going on with the TV," he went on. "It seems all bleary, but nobody sees it but me."

That didn't make much sense. Young Hank was a firm teetotaler. But he sounded desperate, so I went right over.

CONTINUED

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NO PICTURE, brightness and sound okay, no visible snow—what's wrong? Chances are your video-amplifier tube is dead. Replace it. If sound is also bad, try the video detector.

The Pink Elephant took its name from Disney-like pachyderms cavorting across the ceiling. When I entered, several customers were watching TV. Hank was fiddling with the controls.

"Looks like a pretty good picture to me, Hank," I said as I walked up.

"I know, but wait a minute," he said. "I just turned it on."

Suddenly the picture started to smear—the blacks trailing over the screen as if a rag had been dragged across.

"Look!" Hank cried.

One of the customers winked at me. "The boy is seeing things again."

"Sure, Joe," said another customer. "He's been smelling the corks on those bottles."

Hank's a nice kid and I couldn't go along with the ribbing. I took out my tube tapper, a pencil with a good eraser, and held a mirror up so I could see the screen as I tapped the video family of tubes. When I hit the 6U8 video-amplifier tube, the smear immediately moved and flickered.

What makes a picture smear? The video signal, after it leaves the detector, is made up of frequencies varying from 0 to 4.5 megacycles. These have to be amplified uniformly by the video amplifier. If low frequencies get amplified too much, large dark areas in the picture will smear into the following light area. If high frequencies get lost in the process, there will be a loss of fine detail in the picture.



WEAK, WASHED-OUT PICTURE, weak sound, no visible snow. If you lose most of the contrast and audio is not as loud as it was, check both video-detector and video-amplifier tubes.

A faulty video-amplifier tube is a frequent cause of this trouble. If the elements inside the tube move the tiniest fraction of an inch, the tube's characteristics can be upset, and it will no longer amplify uniformly.

In this 6U8, the elements had become loose and were moving slightly because of expansion when the tube heated up with use.

I replaced the 6U8, and the smear disappeared.

Hank junior was triumphant as he turned back to the customers. His principal tormentor was less happy. He brushed by me as he was leaving and snorted, "Kill-joy."

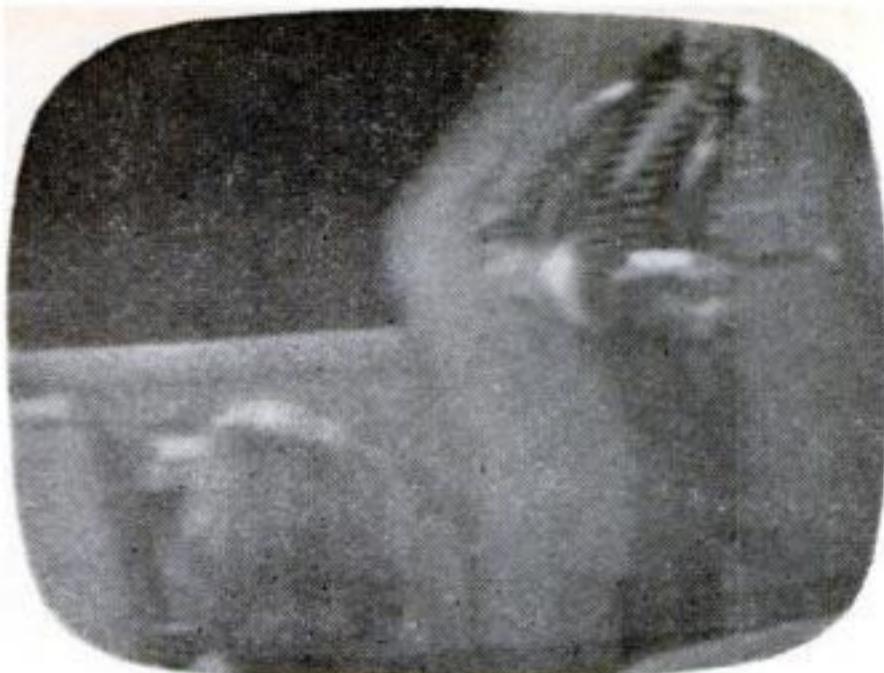
The Case of the Unhappy Joker

I HAD to edge in sideways to get through the door to the dentist's waiting room. I had my tube caddy in one hand and the dentist's repaired portable TV in the other. Just inside, I heard, "Got a match?" A solid thwack hit me between my shoulder blades and I lost my grip on the TV. One corner hit the floor before I could grab it.

There was a roar of laughter and I recognized the braying of Calvin the Card, our town's practical joker.

Restraining impulses of mayhem, I lifted the set to the table and plugged it in. The TV didn't work right. The picture was washed out. I turned up the volume control. The sound was barely

or DC-restorer circuits cause these troubles



HORIZONTAL PULLING like this can be caused by 60-cycle hum getting into the picture through a heater-to-cathode leak in any of the video tubes. Try replacing one at a time.

audible. The symptoms pointed to video-detector troubles.

After the TV signal leaves the I.F. strip, it goes to a separation center called the video detector. Here the sound and picture frequencies are separated from the carrier.

As I was taking the back off the set, a high-frequency whine came suddenly from the inner office.

"What's that?" asked Calvin.

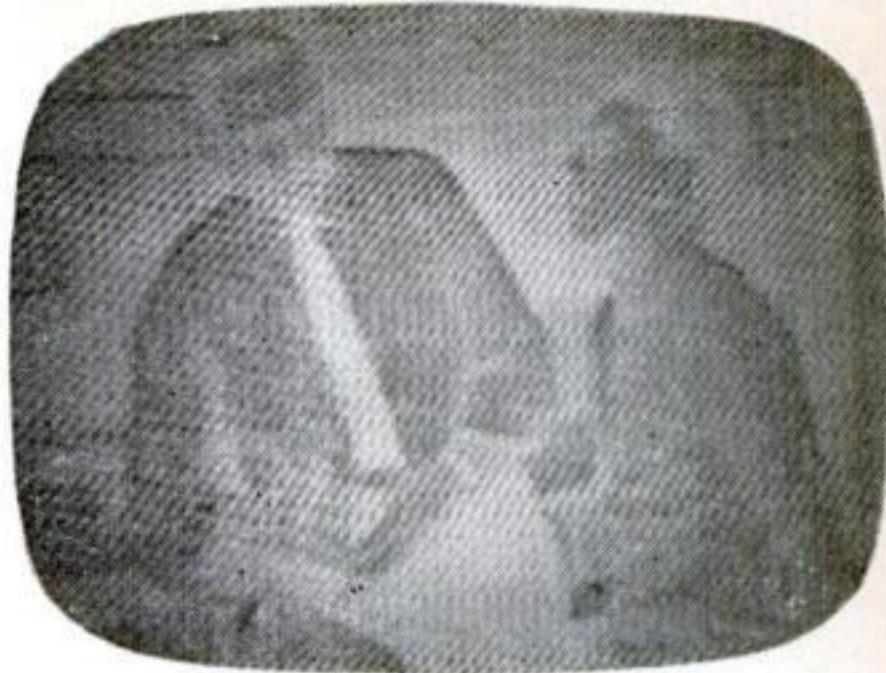
I couldn't resist the chance of revenge. "That's a high-frequency drill. If you're having a tooth drilled, you're lucky. Doc just got it set up yesterday. It turns a lot faster than his old one. Grinds quicker so the drill doesn't stay in your tooth as long, generating heat. You know, it's mainly the hot drill that causes that awful pain when you get a tooth drilled."

I got the back off the set and checked the tube-location guide for the video detector. It was a 5AM8. When I located it on the chassis it looked like a tiny milk bottle that hadn't been washed. A tube looks like this when it cracks and loses its vacuum.

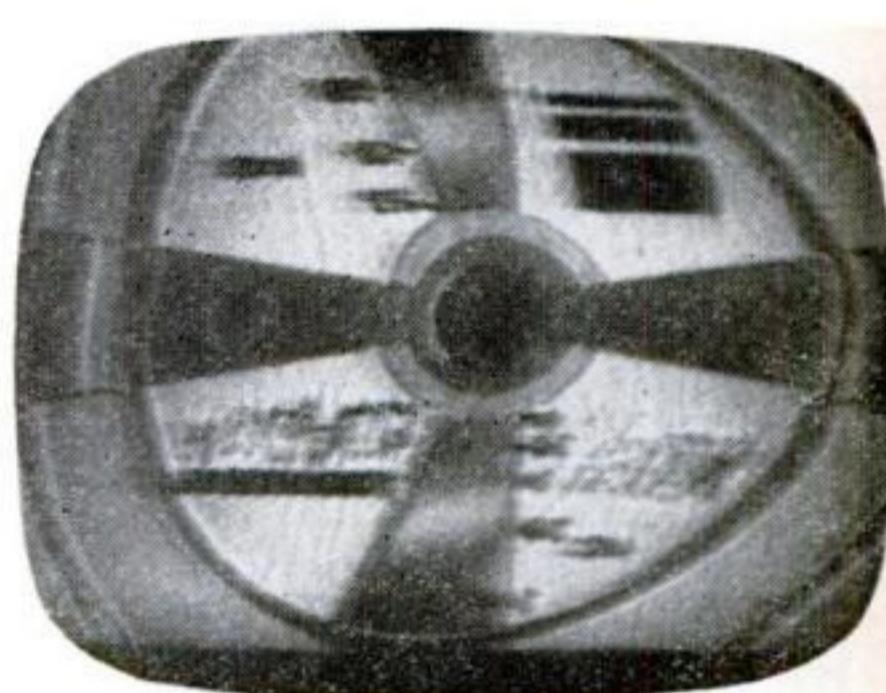
I removed the tube gingerly, using my handkerchief so it wouldn't crack up in my hand. I installed a new one and the picture came on with normal contrast. The audio blasted through the room loud and clear.

The inner-office door opened and Doc said, "Art, come in a minute." He wanted to pay my bill.

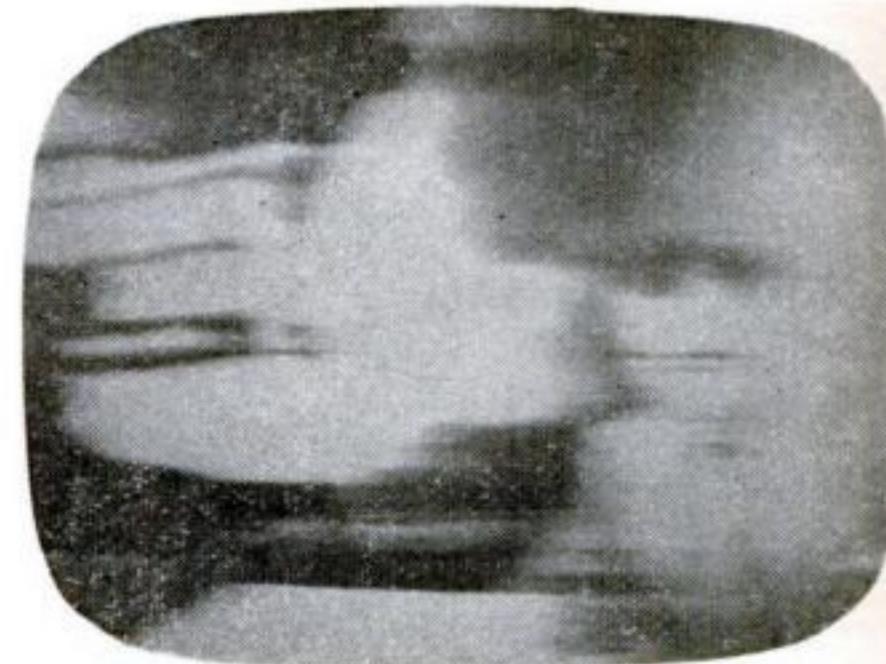
When I came out, Calvin asked appre-



NEGATIVE PICTURE: If your picture turns inside out—the blacks are white and the whites are black—check the video-amplifier tube, the video-output tube, and the DC restorer.



LOSS OF GRADATION: If your picture shows only chalky whites and dead blacks with no intermediate shades of gray, your video-amplifier tube has probably become gassy. Replace it.



SMEARY PICTURE: Don't mistake this for a loss of sharp focus. Slight smear shows as a loss of fine detail. In more severe cases, blacks trail into light areas. Check video amplifier.

Defective video tubes also cause these two faults



BAS-RELIEF EFFECT: If your picture develops this ghostly condition—technically known as "ringing"—a defective video-amplifier tube could be responsible for the trouble.

hensively, "What did Doc want you for in there?"

"His high-speed drill conked out and he thought I might know how to fix it," I said, tongue in cheek. "He hates to have to use the painful old-fashioned one—it hurts the patients so much."

Calvin paled. "Tell Doc I just remembered another appointment," he called as he shot out the door.

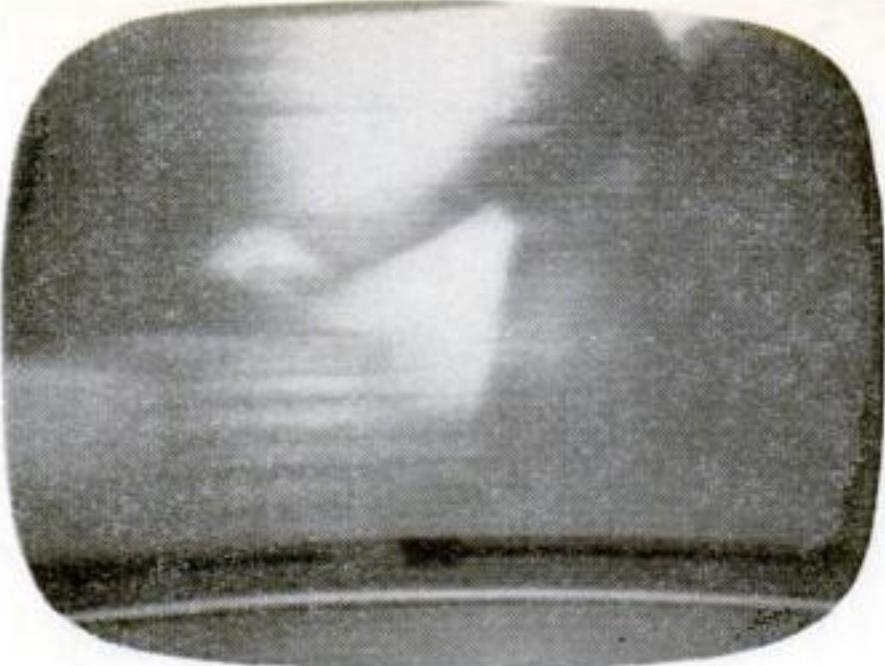
The Case of the Traveling TV

OUR shop is near a large steel mill. Ships from South America supply the mill with ore. One of the ships has a 21" TV that I service. Last time it was in port the first mate called and said the set was acting up.

I arrived at the ship, went to his cabin, and turned on the TV. The mate was nowhere in sight. Sound came in fine. But brightness and contrast didn't get very strong. The picture was washed out, rolled a bit; retrace lines showed. Brightness varied without my touching a control.

There's a circuit in a lot of TV sets that often gets overlooked in troubleshooting. It's called the DC restorer. Here's what it does:

Signal voltage from the video amplifier representing the picture information is fed to the grid of the picture tube. Voltage on the grid controls the stream of electrons bombarding the screen of the picture tube to form the visible picture.



ROLLING AND TEARING: Complete loss of synchronization that cannot be remedied by adjusting the hold controls can be caused by defective video-amplifier or DC-restorer tubes.

Variation in voltage makes the picture elements light or dark.

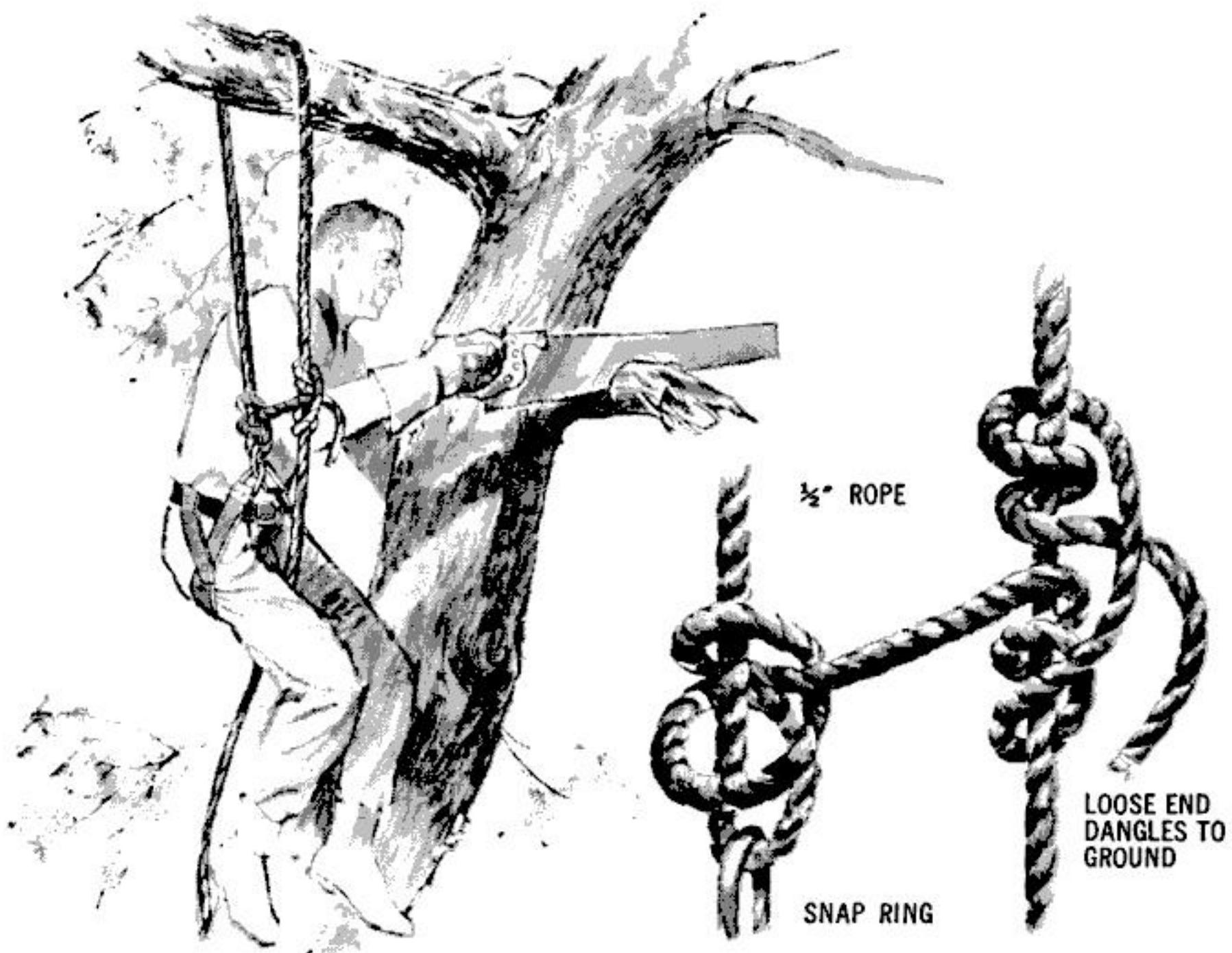
The difference between light and dark is the contrast. But the strength of the video signal also affects overall brightness. Its level should remain constant. The DC restorer is an automatic brightness control. Its circuitry takes a sample of the average video signal and adjusts the operating voltage on the picture tube in accordance with the signal.

If you lose the DC restorer, you also lose the automatic brightness control, and the brightness will be erratic, as in the ship's TV. This would be annoying enough to a viewer at home with a stationary antenna. However, on a moving vessel where the distance from the transmitter is changing constantly, the picture becomes impossible.

I looked at the tube-location guide. The DC restorer was one half of a 12AU7. This is a double triode—two independent tube functions inside one glass envelope. When I looked closely, I could see that only one of the two filaments was shining. I replaced the tube. The brightness became steady and the contrast cleared. I packed up and left.

Two weeks later, on his next trip, the mate stopped by the shop. "You missed out on a job by not showing up last time, Art. That TV trouble mysteriously cured itself. I can't figure it out."

"I'll solve the mystery for you, Mac," I said, handing him a bill for the repair job.



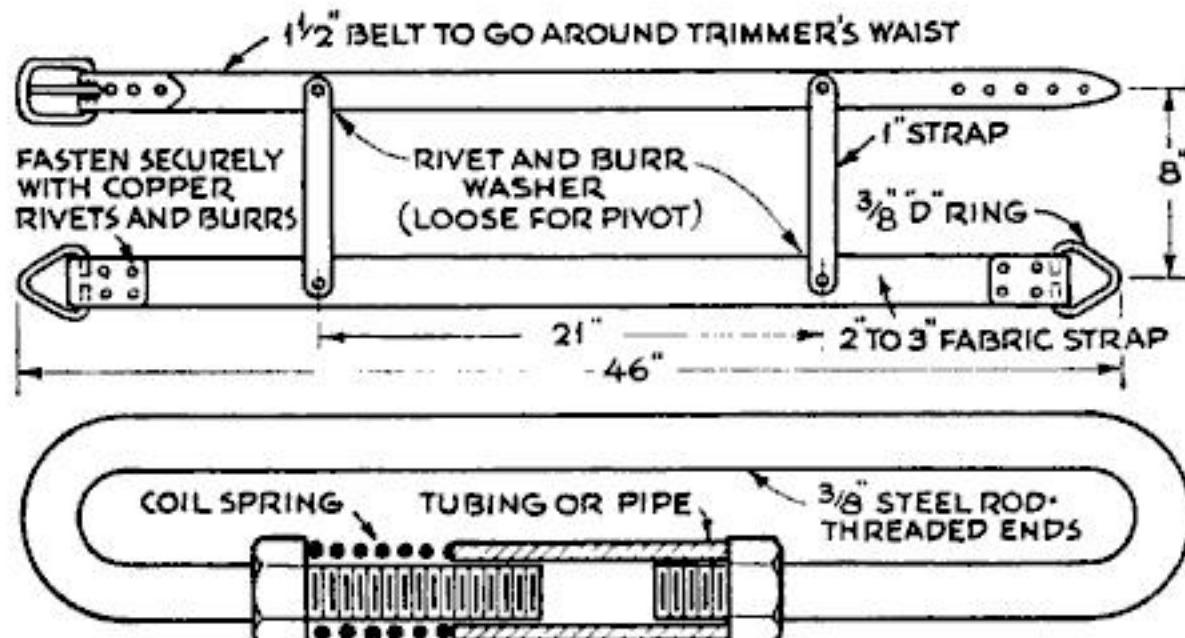
Trimmer's Sling: The Rig for Safe Treework

LONG experience in professional tree trimming left me dissatisfied with the lineman's belt so often used for this work. For greater freedom of movement and access to out-of-reach spots, I use the special sling shown here. To set it up, a line is passed over a high limb. A snap ring is tied 3' from one end and hooked to a safety belt. The 3' end of the rope

is looped into a slip knot that holds you at any desired height. You push this up and down the ground line to change position.

Since leather may deteriorate, fabric belting is safer for the seat strap. If you can't locate the proper D or snap rings, you can make your own from $\frac{3}{8}$ " steel rod. The sling is safer than the lineman's

rig since it suspends you from a limb you can test before you pull yourself up. You can walk out on limbs that won't bear your weight, because the rope needn't be vertical to support you. You can't fall, even if the limb you're standing on fails, and since you never have to do overhead trimming, you can't be injured when a cut limb drops.—G. Allen Burrows, Burt, N. Y.



Tips for the Portrait

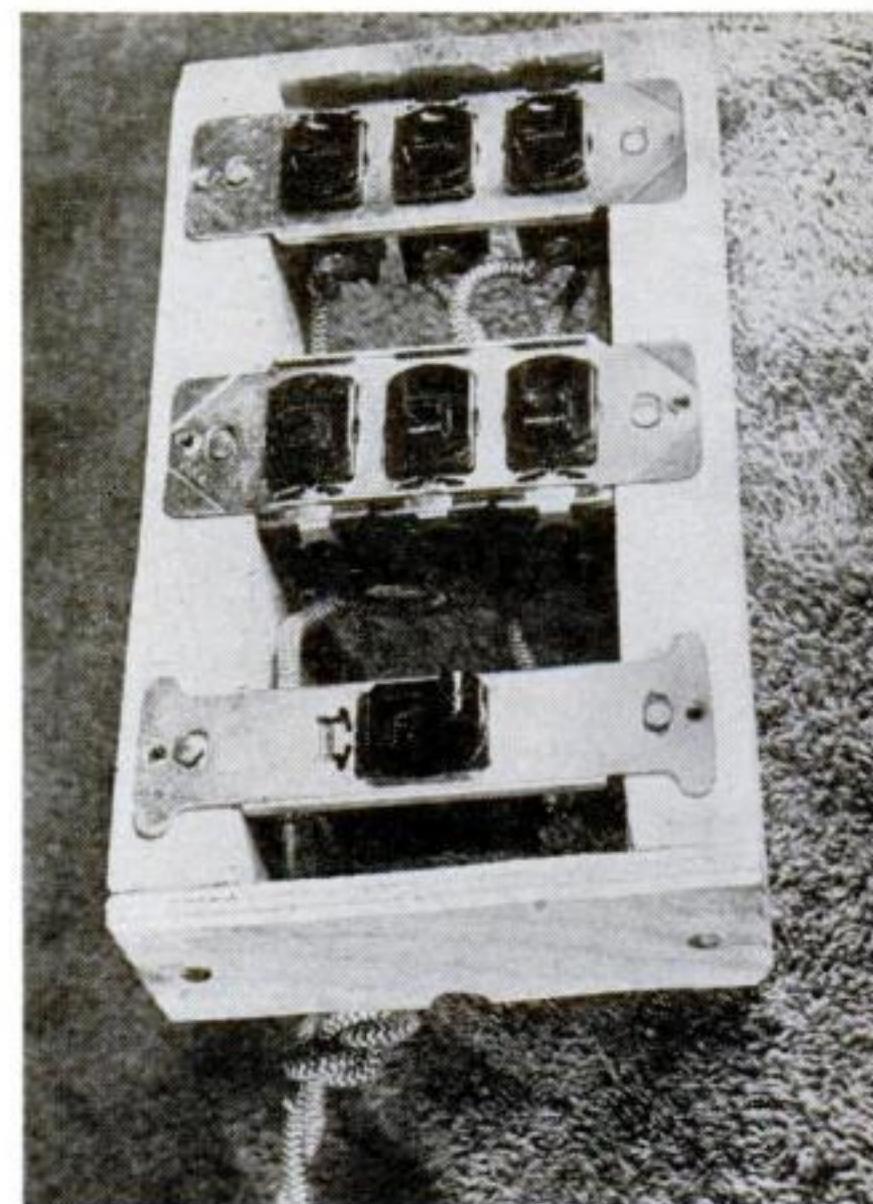
Dimmer-Switch Box for Photofloods

You get longer life for photofloods and increased comfort for your models if you make this studio switch box. It provides controls that let you dim two or three photographic lamps during setups, switching them to full brightness only during exposures. Feeding less than 110 volts to a photoflood—so that it burns about as bright as a household bulb—will make it last much longer.

Three ordinary switches (two on-off and one three-way type) change the circuit from parallel (bright) to series (dim). Another on-off switch controls current to the box itself. All four switches and the three two-pole outlets are of the individual replacement type.

These seven fixtures are mounted in a simple frame of $\frac{3}{4}$ "-by- $1\frac{1}{2}$ " pine sides and $\frac{1}{4}$ "-plywood ends and bottom, assembled with screws. Length and width are determined by the size of the switch plates, which form the top. When wired as shown in the diagram, the switches may be thrown simultaneously or in any sequence without short-circuiting.

SWITCH POSITIONS					
Switch	TWO LAMPS (Sockets 1 & 2)		THREE LAMPS		
	Bright	Dim	Bright	Dim	
B	2 (down) on (down)	1 (up) on (down)	2 (down) on (down)	2 (down) off (up)	
C	on (down)	off (up)	on (down)	off (up)	
D					

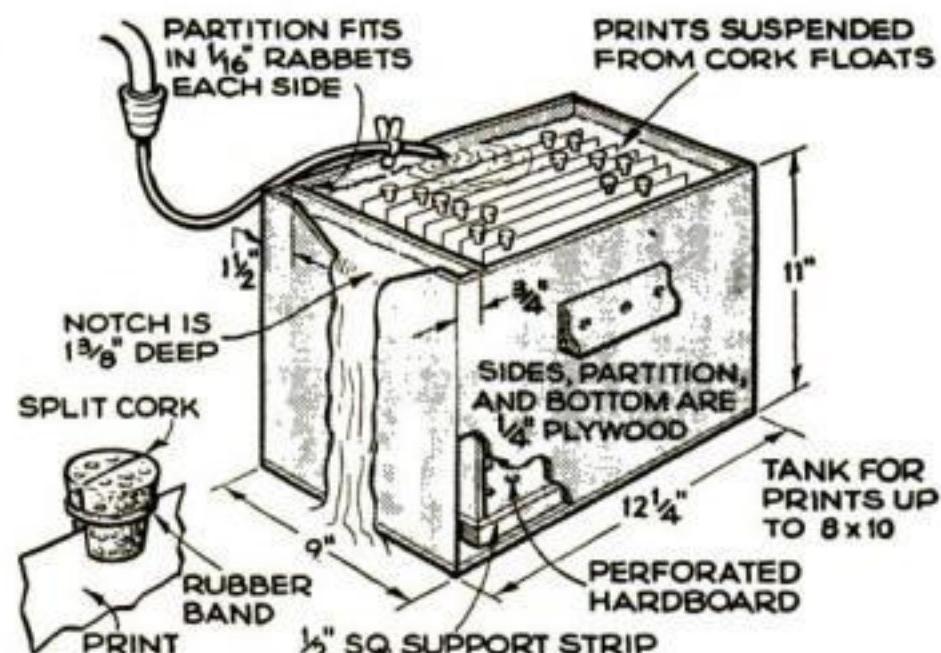


MOUNT SWITCHES so that toggles point down when B's No. 2 pole is "live" and C and D are on. This lower side of the cover plate can be labeled "Bright," since switches are in this position for either two or three bright lights (when



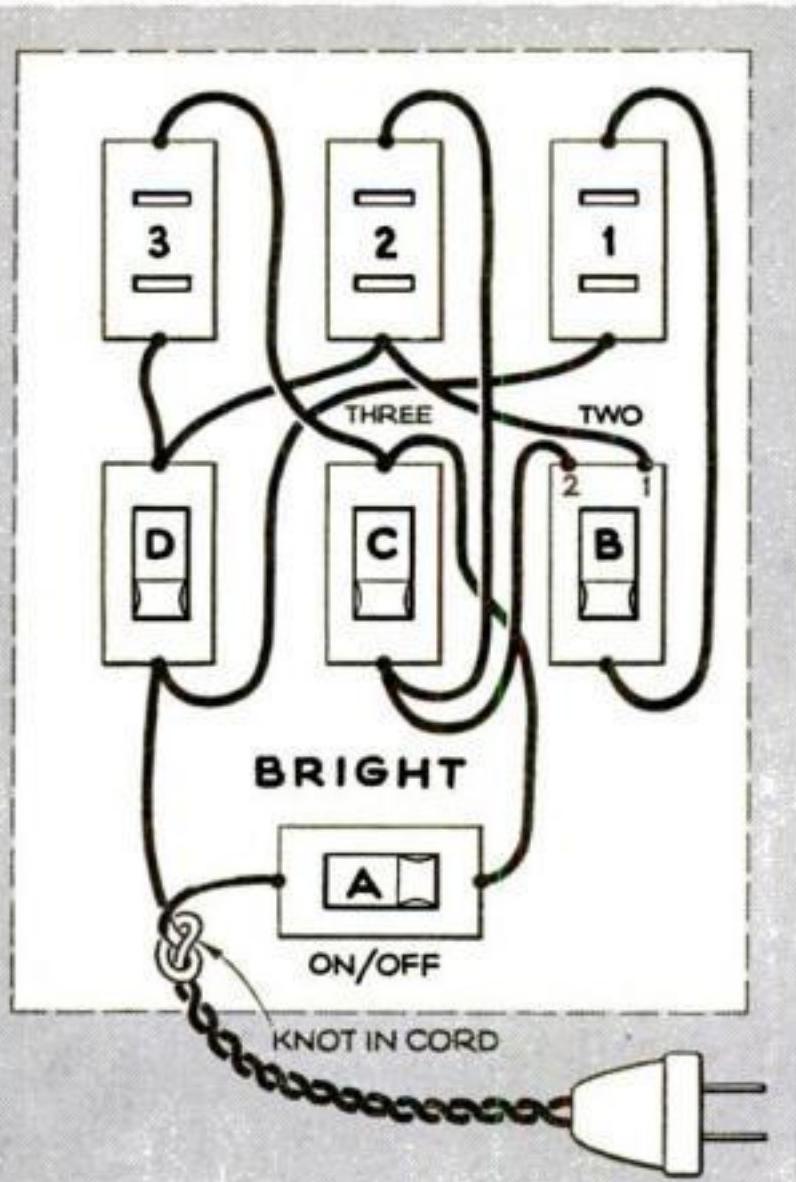
FILTER FACTOR UNKNOWN?

You can check it. Point your meter at a constant light source, then hold the filter directly in front of the photocell. The drop in the reading indicates the amount of light the filter holds back.

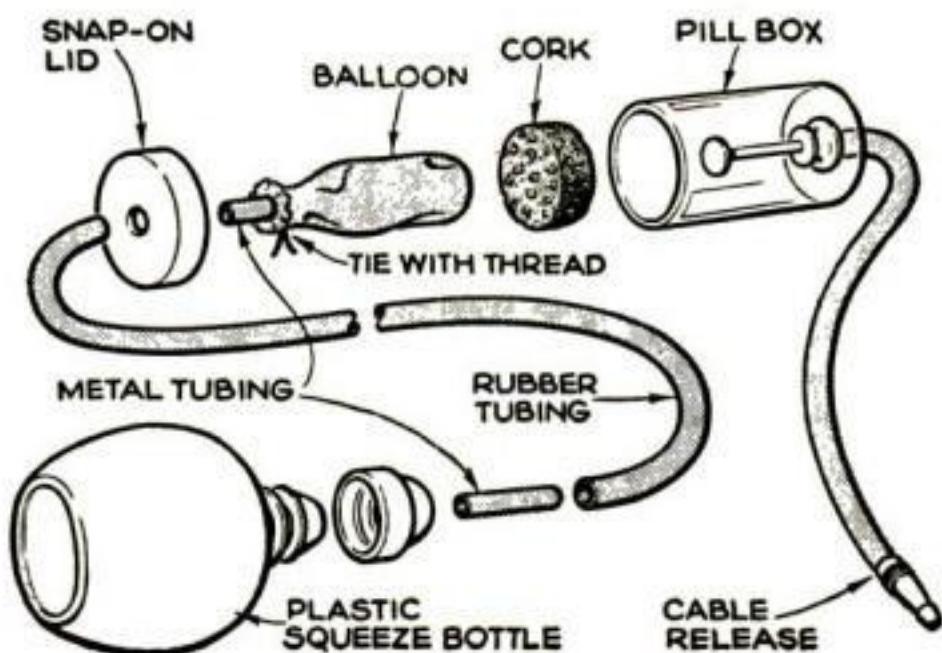


PRINTS WON'T STAIN if floated in this homemade wash tank. It flows hypo to the bottom, through the filter, and back up over the notched end wall. Assemble the tank with waterproof glue. Fill any gaps with plastic wood and treat the inside with two coats of fiber-glass resin. Seal partition, filter tray, and support strips before assembly. After sealing outer surfaces, apply two coats of enamel.

Photographer



using only two, the third lamp is of course unplugged). On the upper side, paint "Two" by switch B and "Three" by switch C, to indicate their proper positions for dimming two or three lights (for toggle positions, see chart).



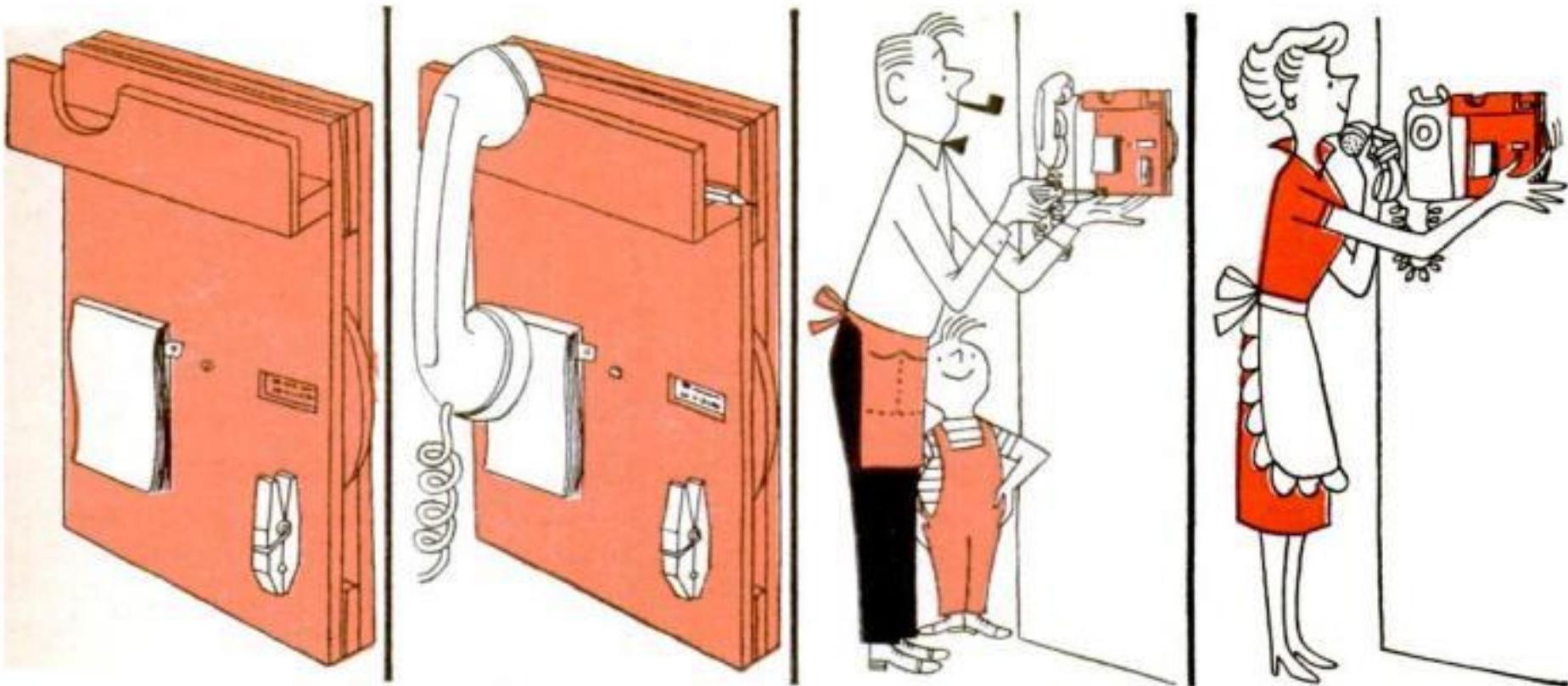
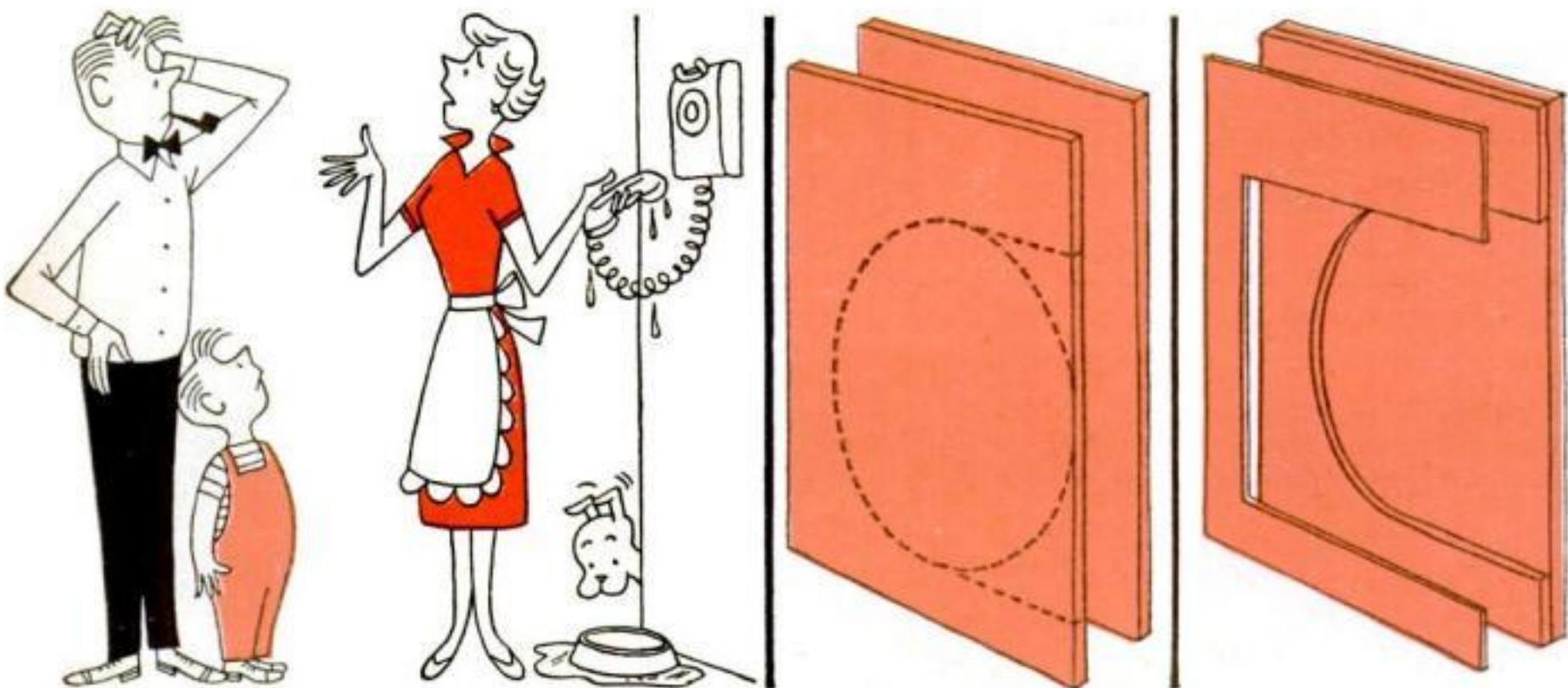
TAKE YOUR OWN PICTURE with this remote-control shutter release. A nasal sprayer on a long tube inflates a balloon, tripping the shutter. Remove the spray head and replace the plastic tubing with a piece of ball-point-pen cartridge for attaching the air line. Bore holes in lid and bottom of a plastic pill bottle and cut a cork to insert over the cable release. Lubricate this "piston" with talcum.

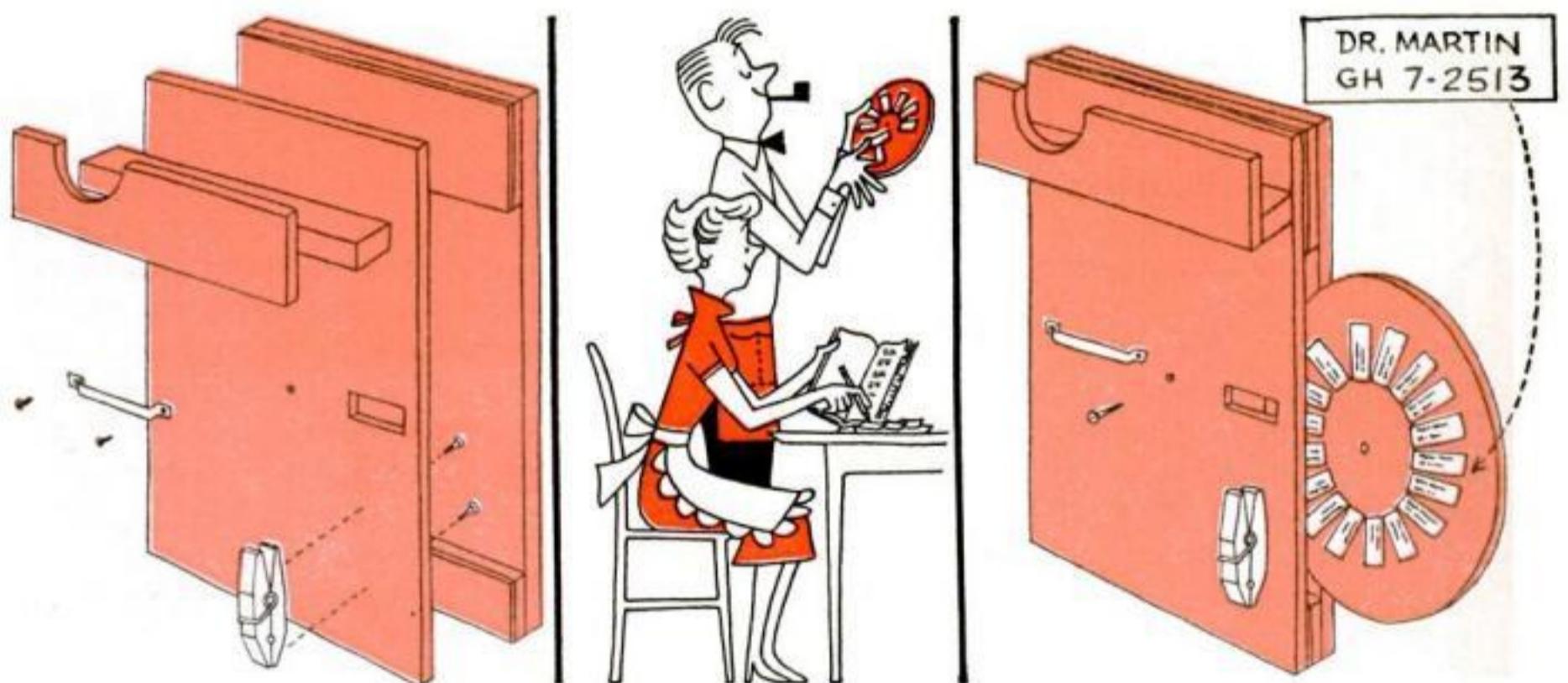
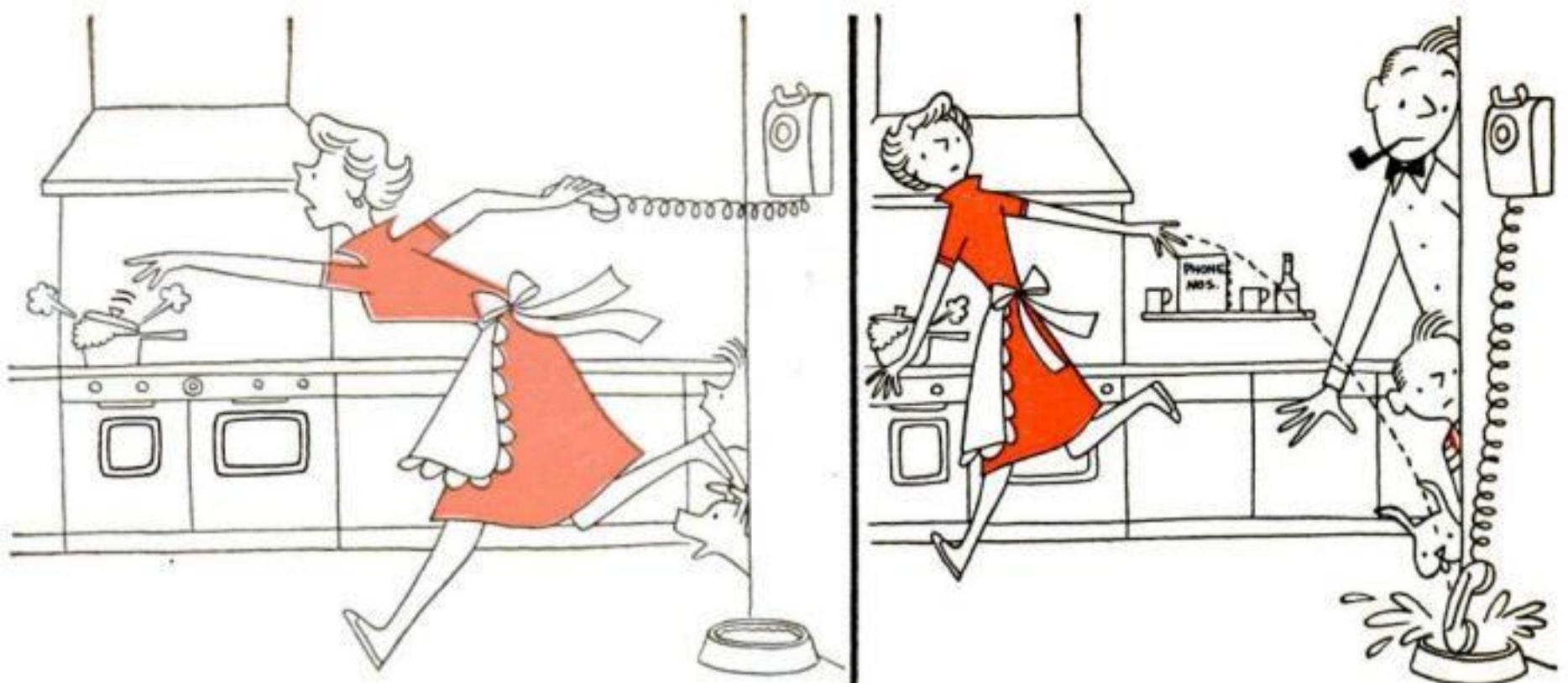


ENLARGER DIFFUSERS built in for portrait work usually are mounted on an under-lens arm that swings aside when not in use. In this position, the diffuser collects dust. Cover it with aluminum foil until you need it again.

Wordless Workshop

By Roy Doty
and Wayne Ulbricht





← TICO
hates
TINA →
...and the
feeling is
mutual

Day or night, outdoors or in—

My Two Dogs Never Meet

By Harold G. Hunter

OUR two pets present a problem in canine relations. We love them both, but they can't stand each other. Tico's been with us for all of his five years. Tina is a half-year-old interloper. Whenever they met, fur flew—and meet they had to, if they were permitted free access to the house to eat and sleep.

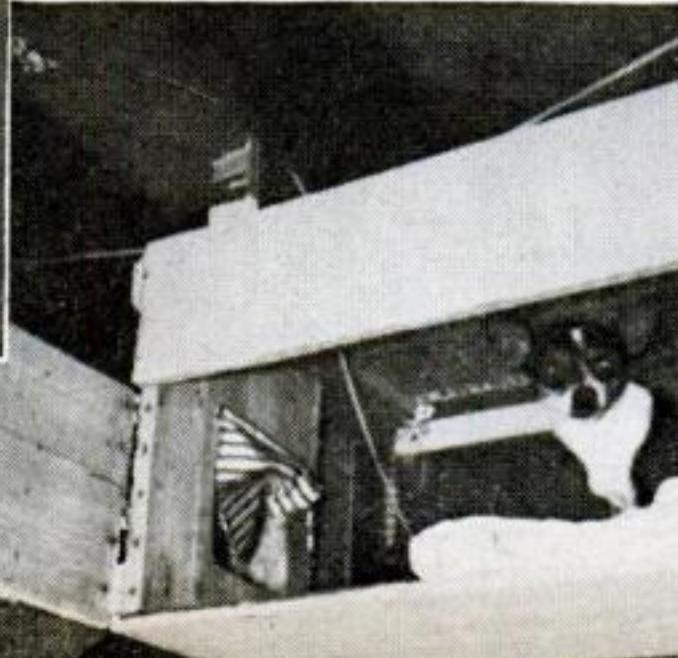
My solution may be elaborate, but it saves us from dashing all over the house and grounds to referee quarrels. Through

a system of gateways and lath-cleated ramps, each pooch can pass from a separate yard pen to its own fenced-off area in the basement—and each can climb (on a different meal schedule) to a feeding platform beneath the sill of the kitchen window. All three control gates can be operated from the kitchen by means of ropes and pulleys.

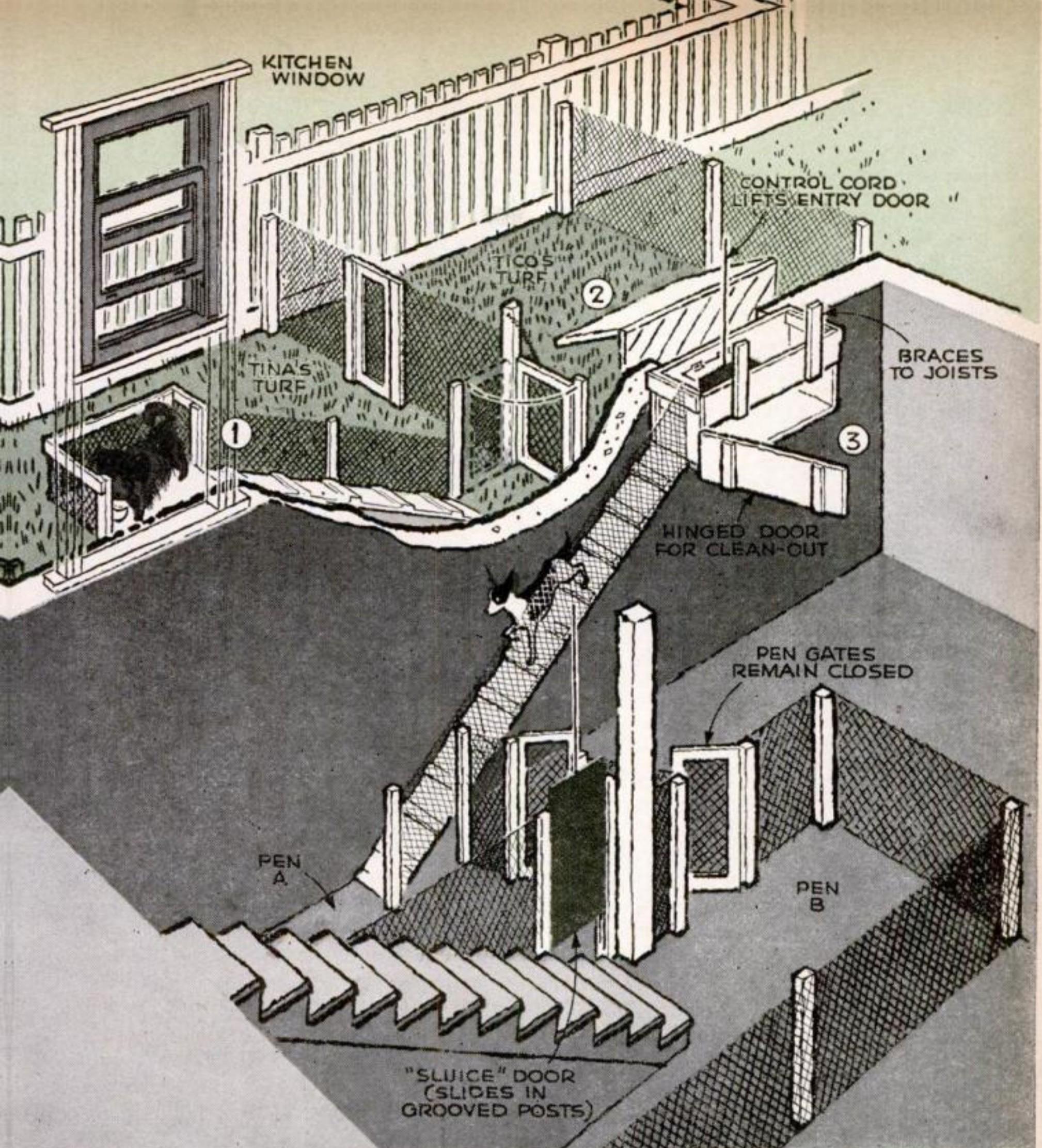
Ramps and platform are fenced with small-mesh poultry wire, to prevent tumbles. The outdoor ramp is partially concealed by a rose trellis. For the basement fencing, we use old window screens.

1. Tina waits patiently for a hand to reach out the kitchen window with her evening meal . . .

2. . . while Tico, outside cellar window, listens for raising of door inside the flap.



3. Move on, boy—your bed's below! The flap at left is the exit to the basement ramp.



Here's how it works

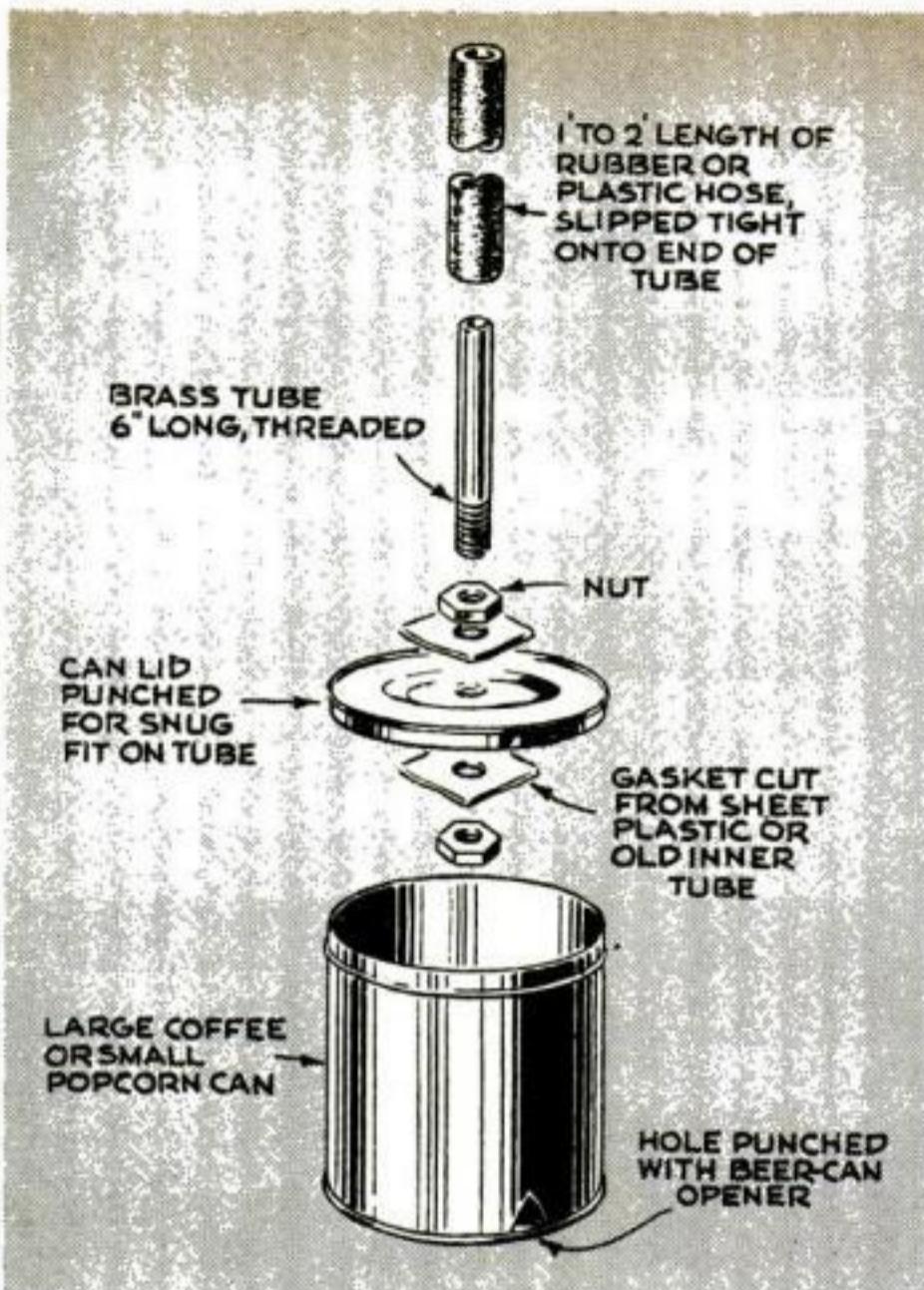
The sketch above shows the setup during an evening meal. To start with, each dog was in his own yard pen. Tico got the first chow call. With the two-way gate swung away from the house, he was free to mount the outdoor ramp to feed. When done, he returned through his own pen, and the gate was swung against the

house wall (cut away, here), clearing the route for Tina's climb to dine. Meanwhile, the top-hinged door inside the cellar-window flap was raised—Tico's cue to enter the window box and proceed down the interior ramp, as shown. The sluice-type door onto the stairs is raised.

When Tico passes on into Pen B, this door will drop. Outside, the two-way gate will swing back so that Tina may follow the same route, bedding down in Pen A. (Numbers refer to photos at left.)

Short Cuts and Tips

FROM PS READERS

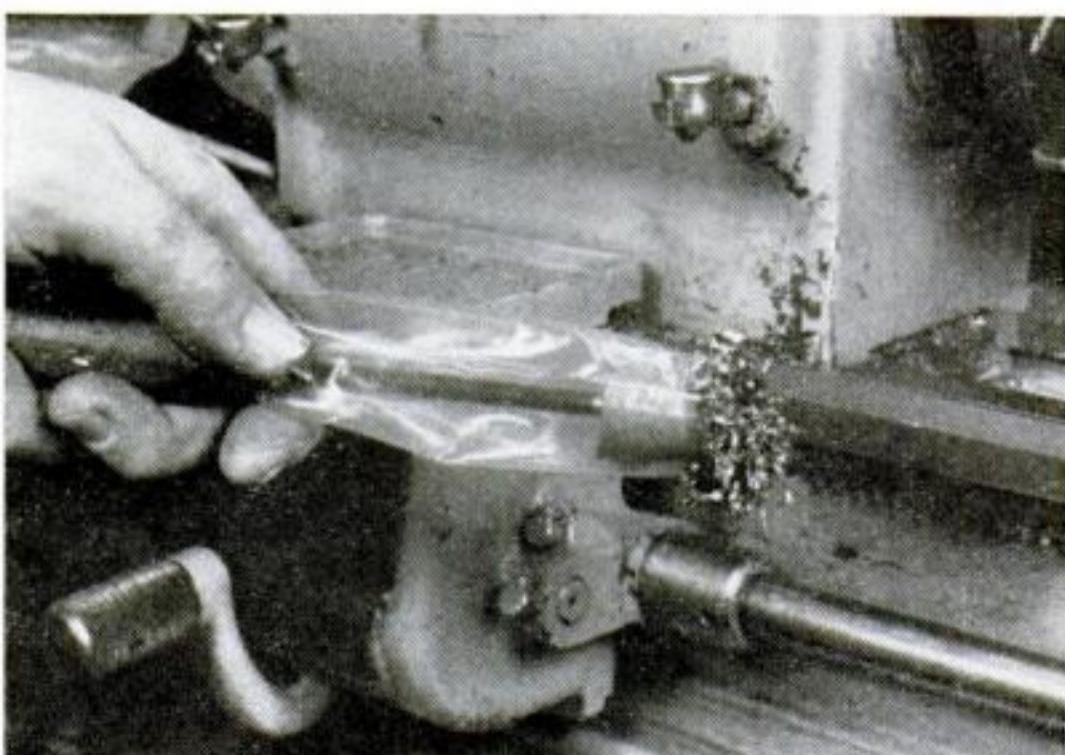


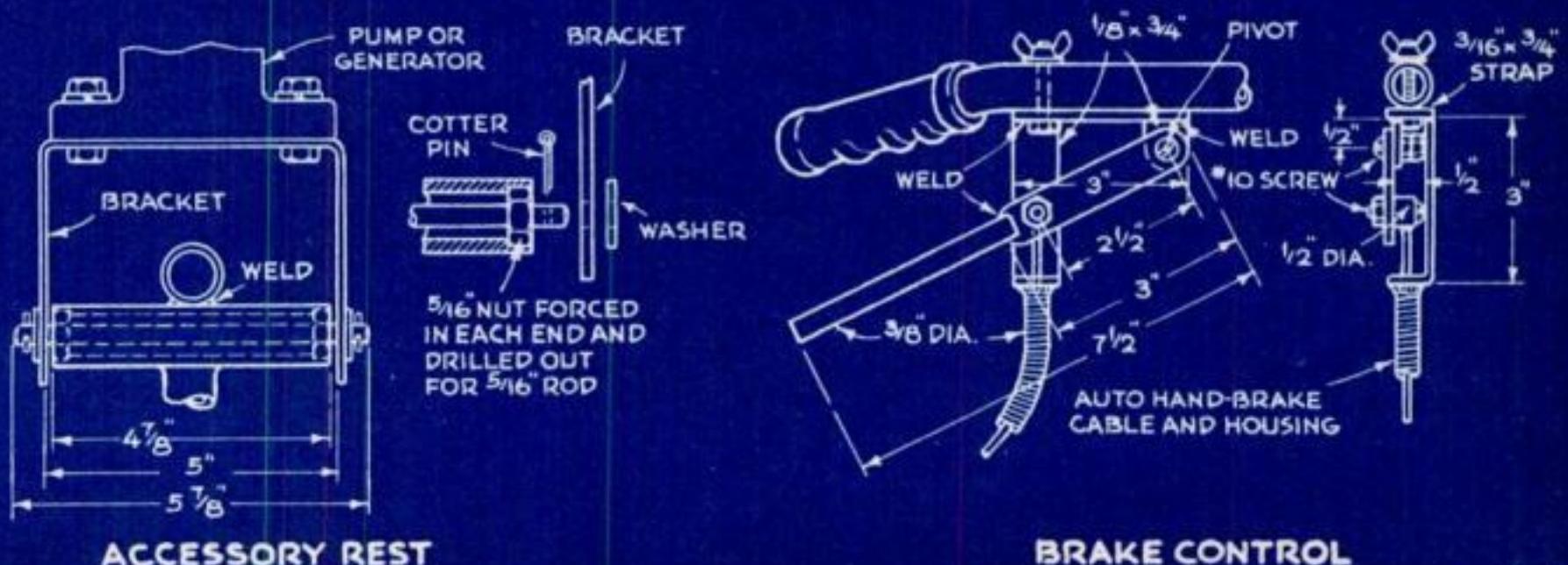
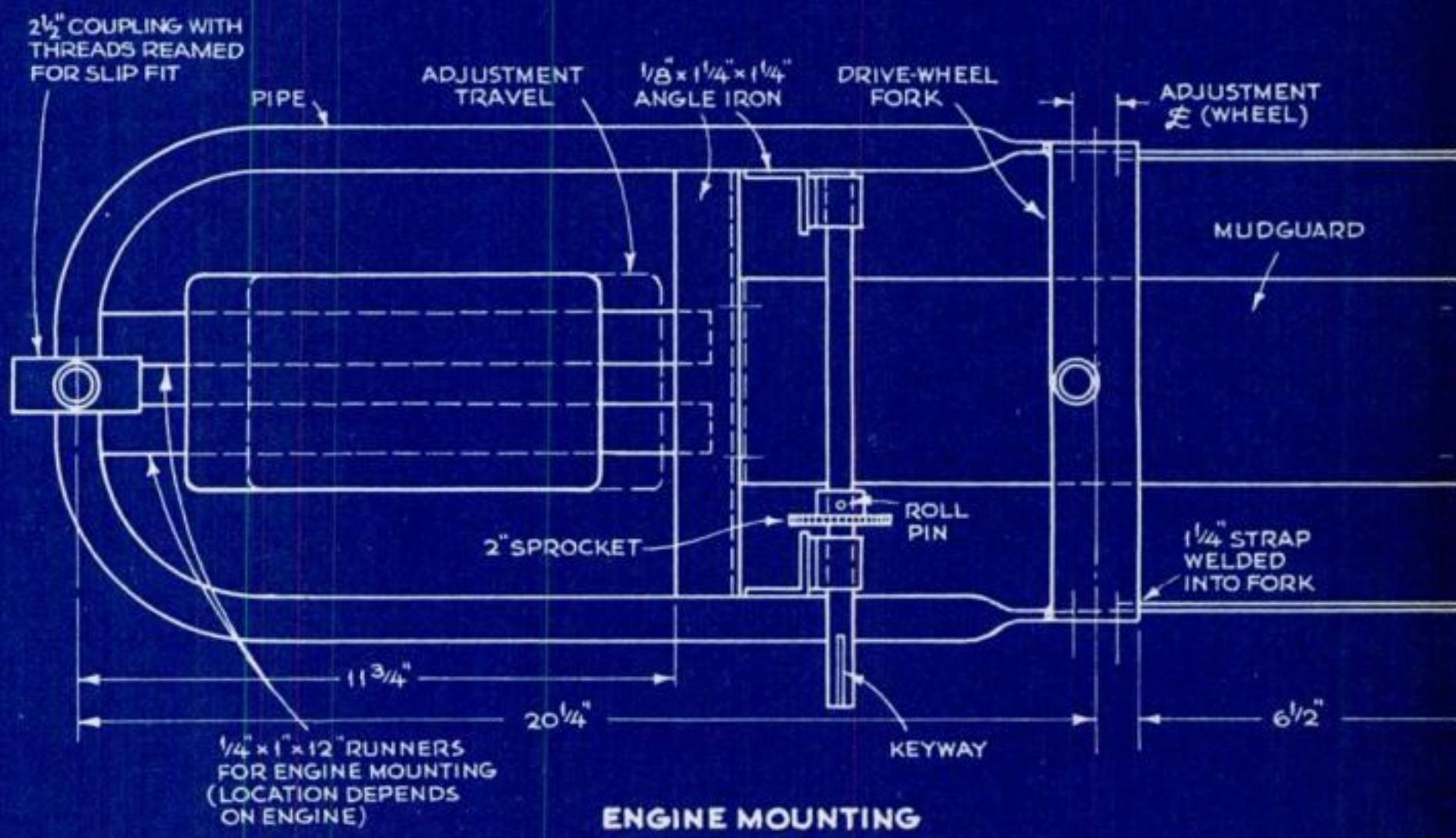
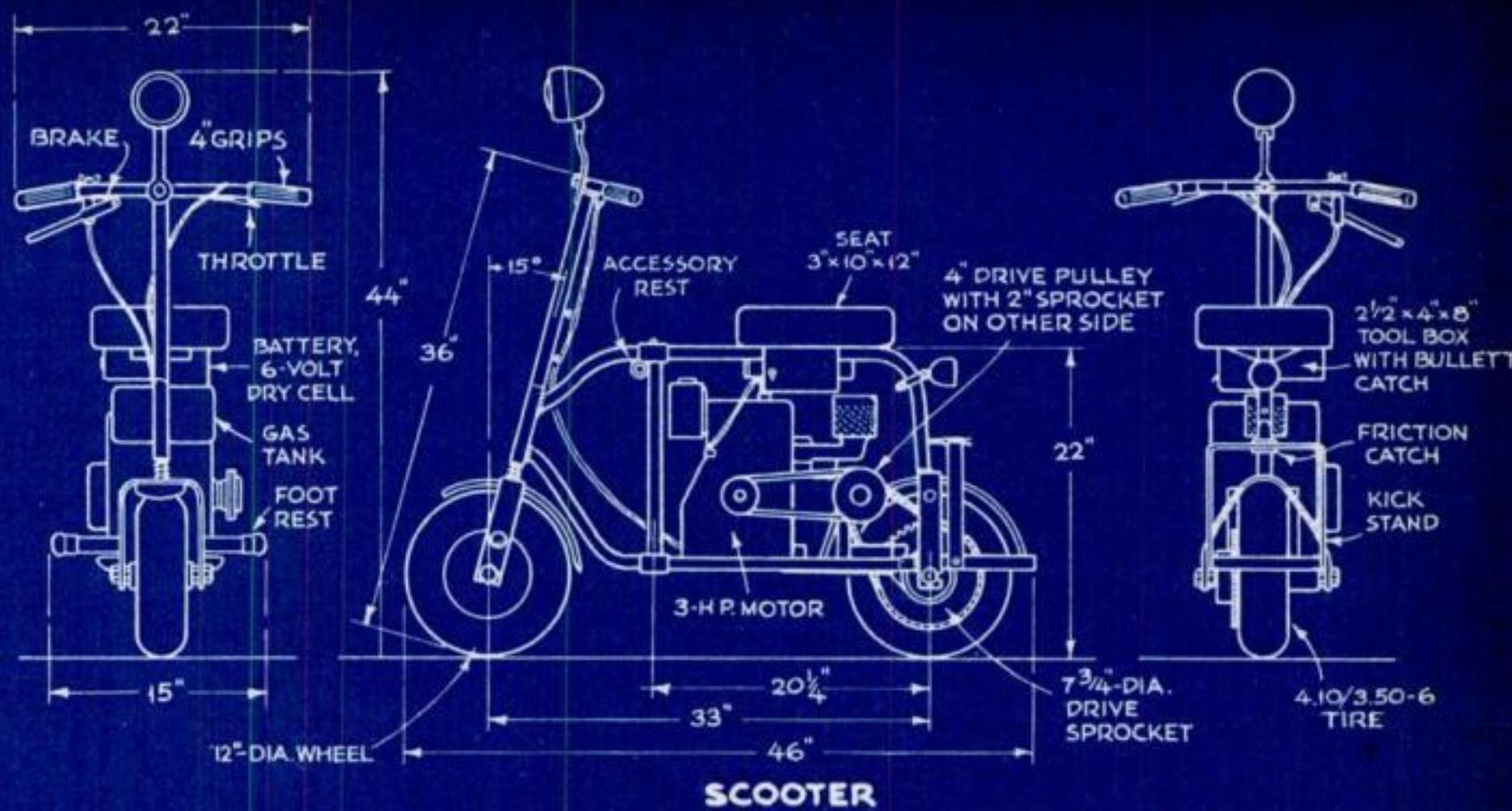
"Vacuum Cleaner" for Plastic Pools

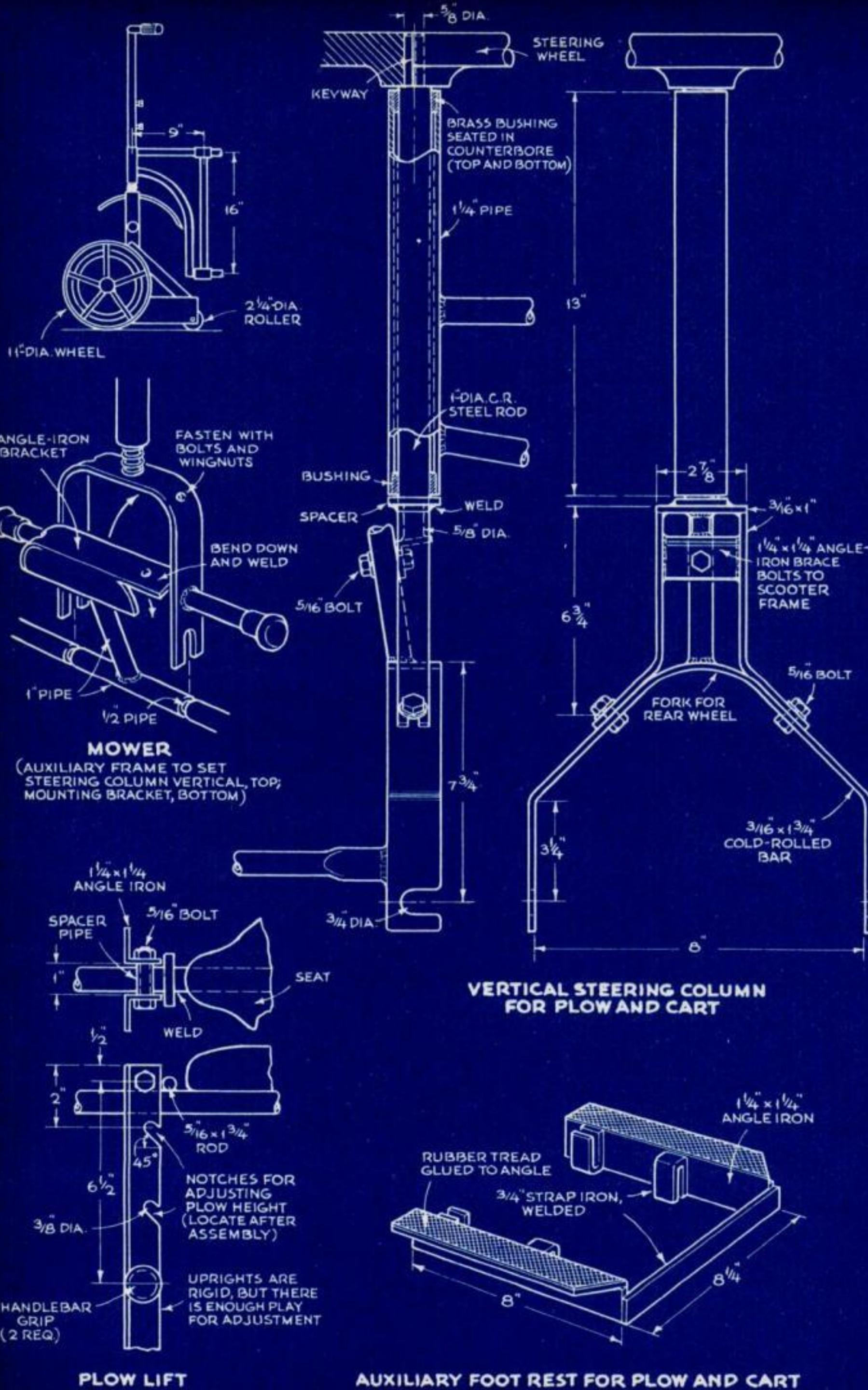
CLEANING dirt and sediment from a portable plastic swimming pool is a problem. Emptying and then refilling it is both inconvenient and costly. I use this homemade cleaning device. First I swirl the water into a whirlpool with a paddle (left). This draws all sediment to the center. When the water calms, I submerge my collecting can, holding my thumb over the end of the hose that stays above water (above, left). I move the can along the bottom until the base hole is against the dirt, then raise my thumb for a second. The dirt is sucked in, along with a little water. I repeat this procedure until all the dirt in the little heap I've gathered has been picked up.—*E. M. Harman, No. Hollywood, Calif.*

Pickup for Steel Chips

A SMALL Alnico button magnet inside a plastic bag is the slickest tool yet for cleaning steel chips from hard-to-reach places. These small but powerful magnets are available with a threaded hole that makes it easy to attach a handle. The handle shown was made by cutting down the blade of a cheap screwdriver. The plastic bag lets you whisk chips off simply by pulling the bag off the magnet.—*H. J. Gerber, Stillwater, Okla.*



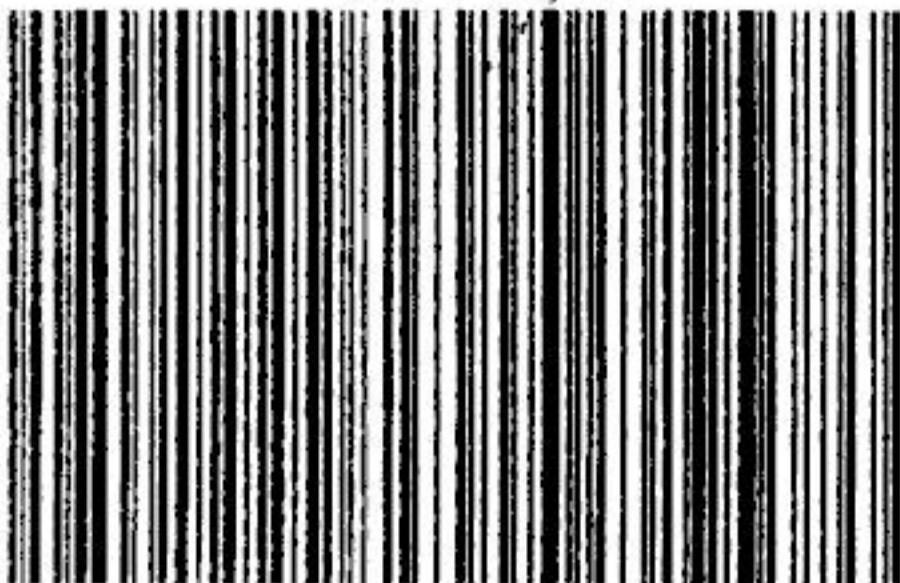




1. Follow instructions on the other side

BACK

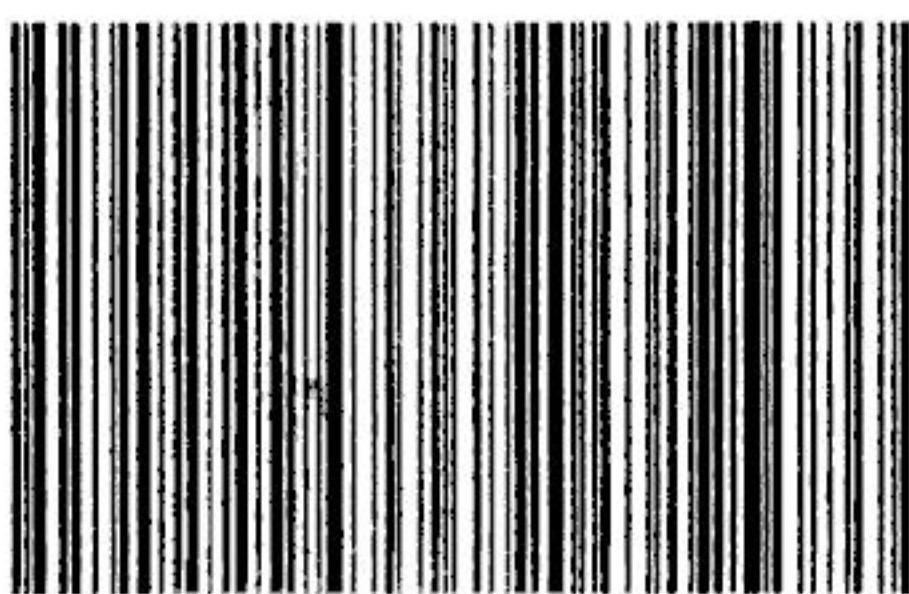
Gbs5lipBack-001B



Inverted Back

1. Follow instructions on the other side

Folded edge of the page



Inverted Foldout slip-sheet

1. Open the foldout page

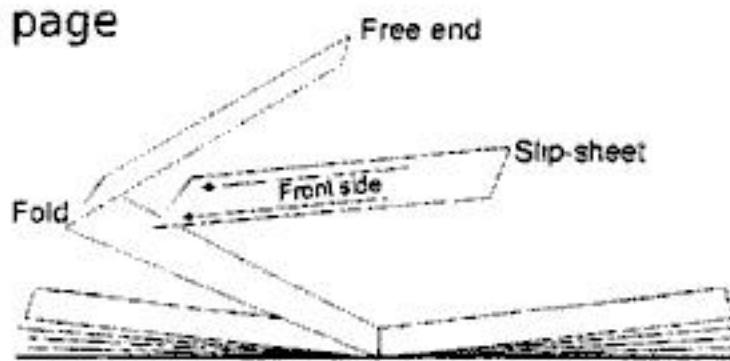
2. Insert this sheet with

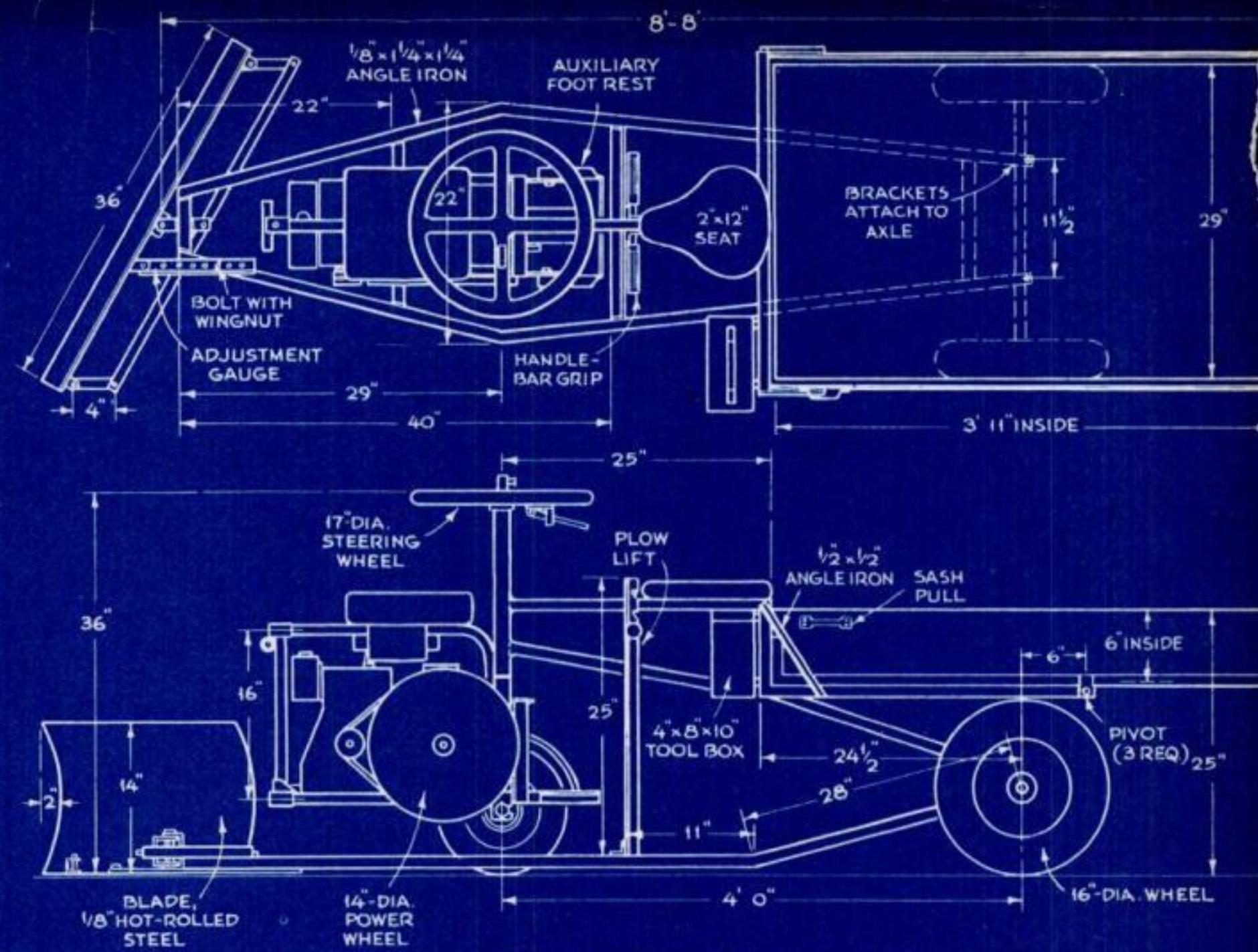
1. Front side touching the free page

2. Arrow pointing to the fold

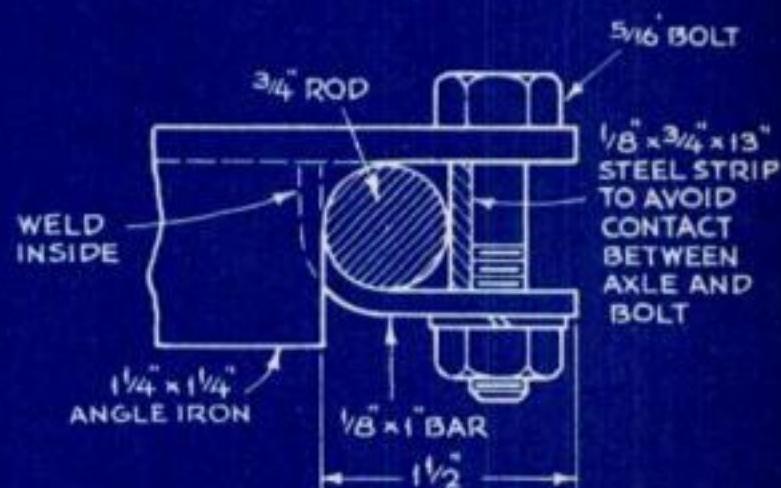
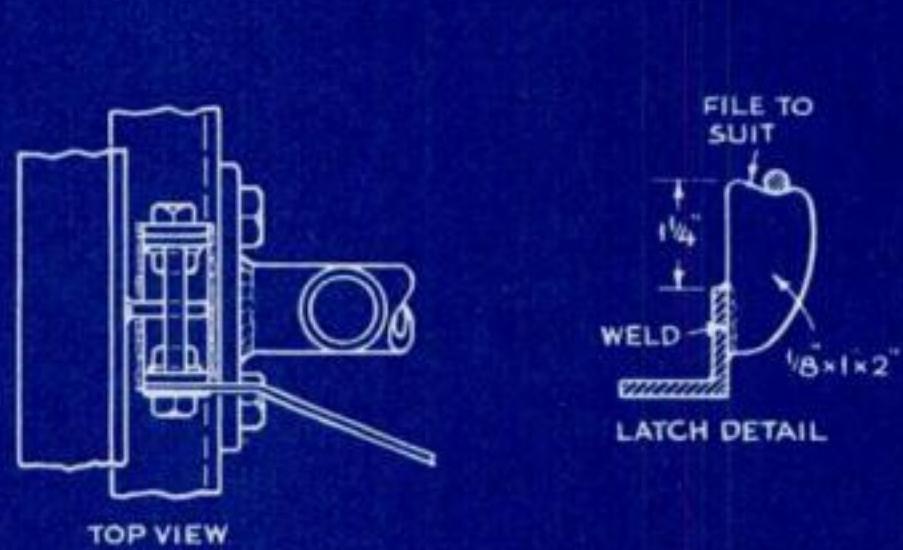
3. Slice the folded edge

4. Close the page and slip-sheet

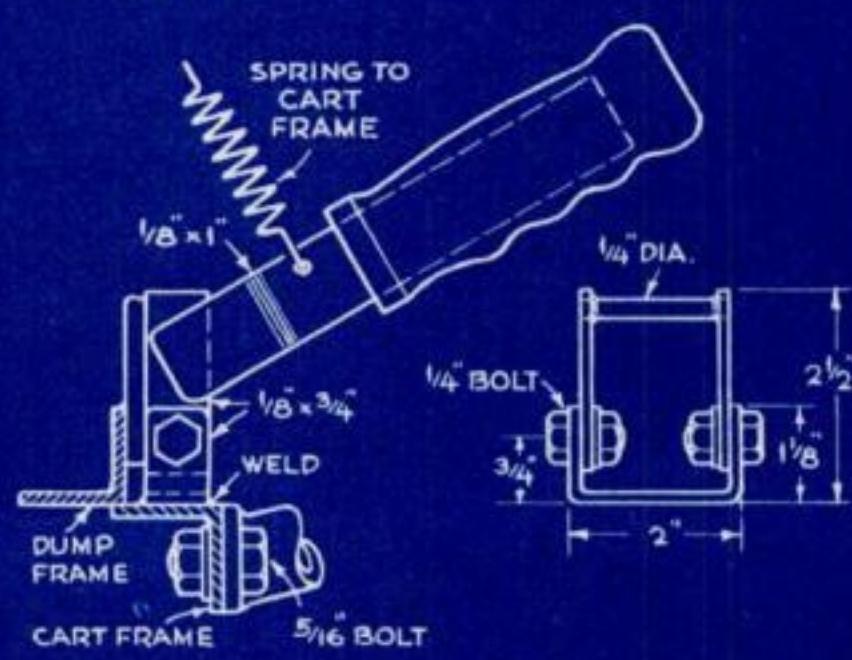




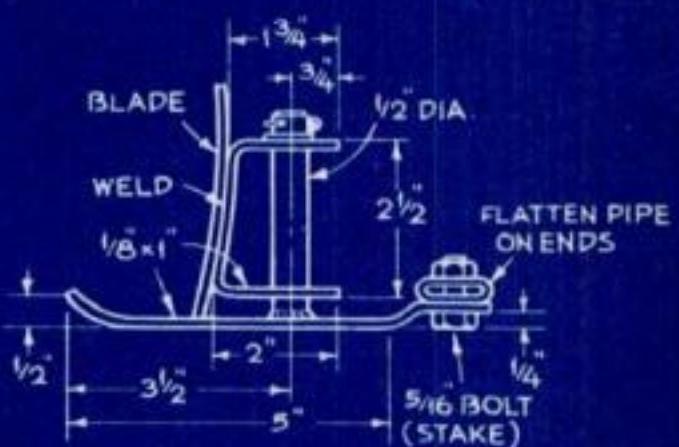
SNOW PLOW AND DUMP CART



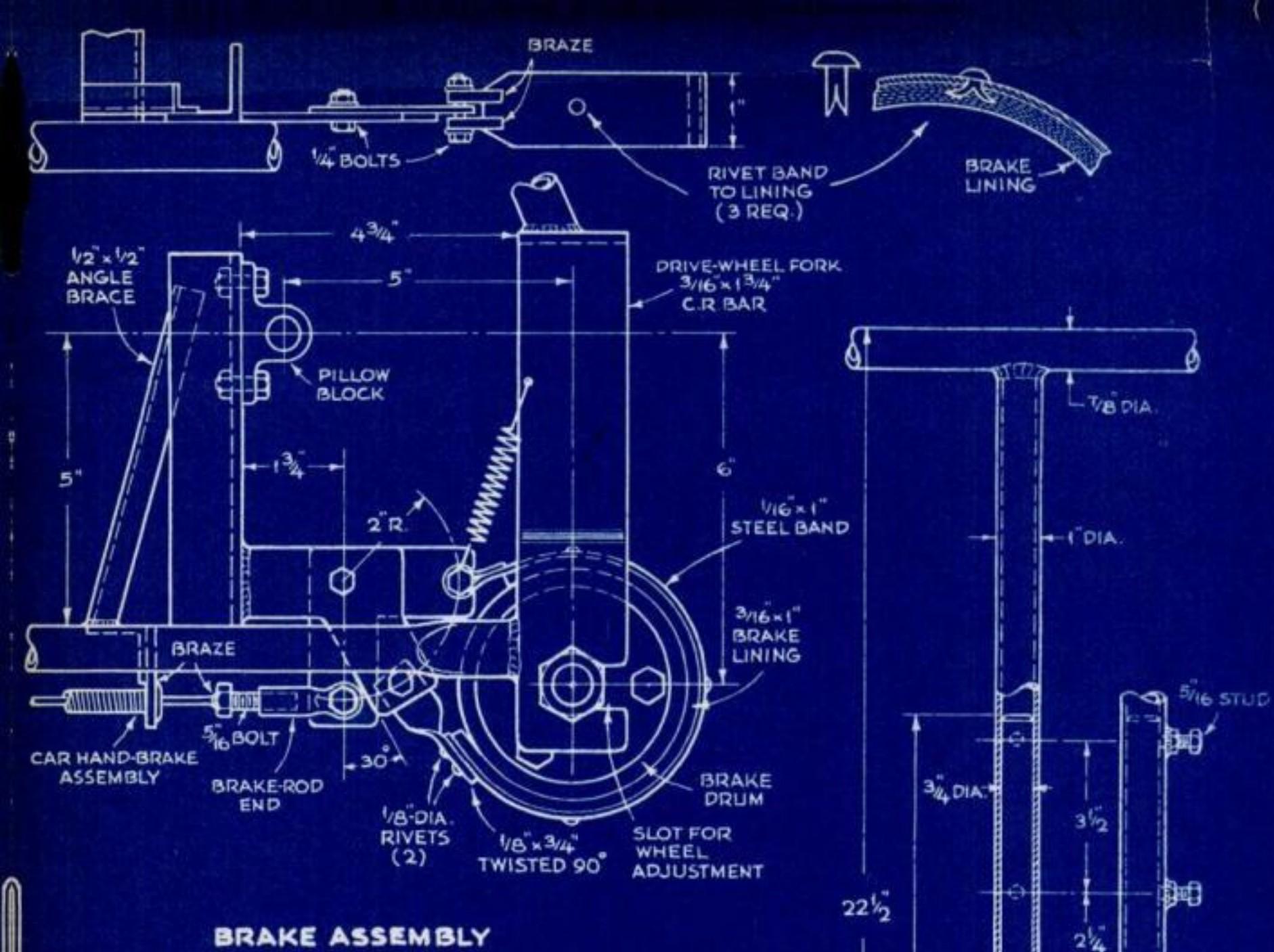
**PLOW-FRAME AXLE
SOCKET**



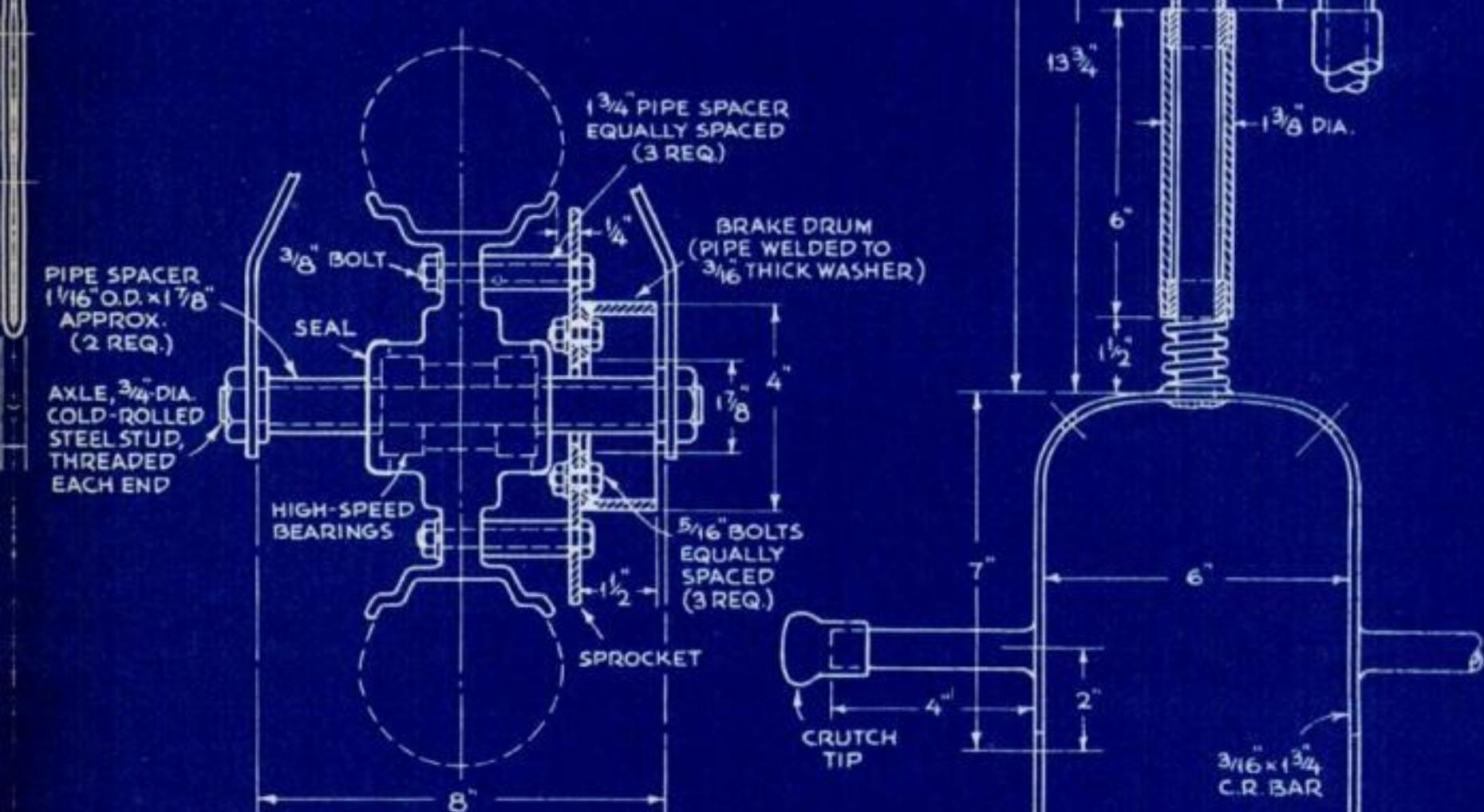
SELF-LATCHING CART CATCH



SNOW-BLADE SKID (2 REQ.)



BRAKE ASSEMBLY



WHEEL, BRAKE, AND SPROCKET ASSEMBLY

STEERING COLUMN FOR SCOOTER AND MOWER

POPULAR SCIENCE MONTHLY, 355 Lexington Ave., New York 17, N.Y.

POWER SCOOTER AND ATTACHMENTS

DESIGNED BY:

Douglas A. Biesecker
Vermont

© 1961 POPULAR SCIENCE MONTHLY

Free Blueprint
shows how to build this
scooter and attachments

All-Purpose Yard Horse

**This 40-m.p.h. scooter earns its keep
the year round by converting to five
powerful machines for use around the house**

By Alfred W. Lees

IT DIDN'T seem likely—until we saw for ourselves. The letter from Clarks Summit, Pa., described a homemade scooter that pulled apart for portability and boasted a set of attachments to convert it into: a hauling tractor, a snow plow, a power lawn mower, a portable electric generator, and a pump.

The inventor, anticipating our skepticism, enclosed a map labeled "Route to Douglas Biesecker." So PS photographer Bill Morris and I drove out to investigate. We found a young man waiting for us, up a country lane identified by the Biesecker mailbox. He straddled a neat-looking two-wheeler with a frame welded up from black iron pipe, angle, and strap iron. "Put it through its paces," we suggested.

CONTINUED



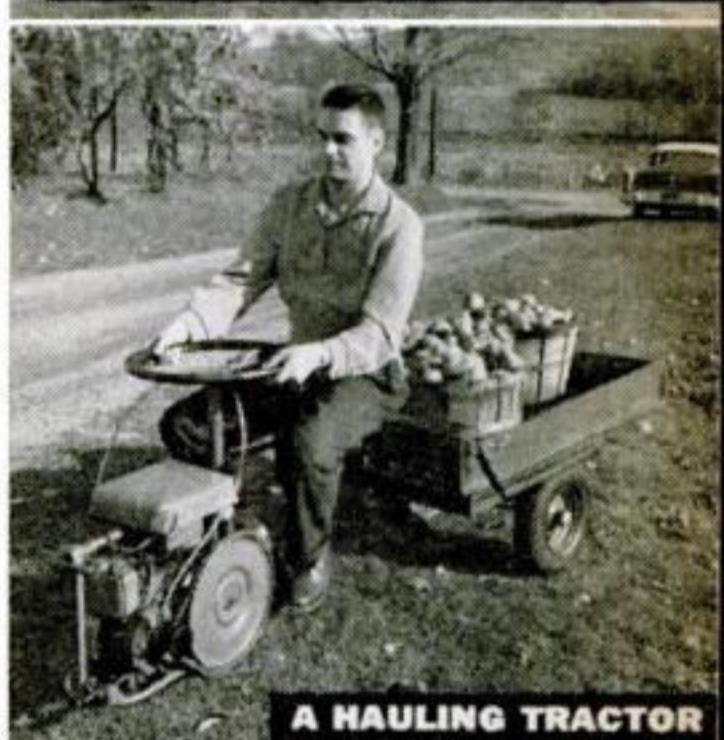
A LAWN MOWER



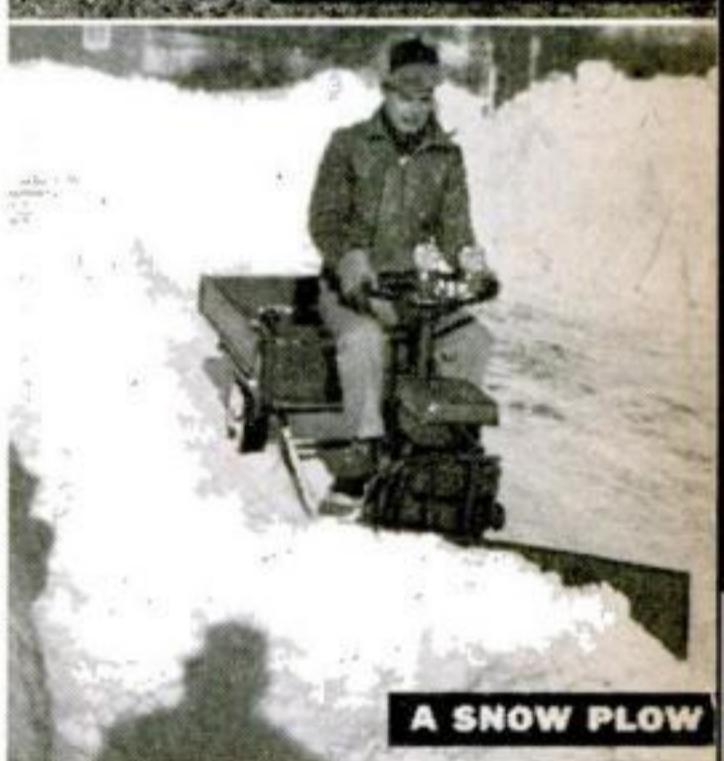
A GENERATOR



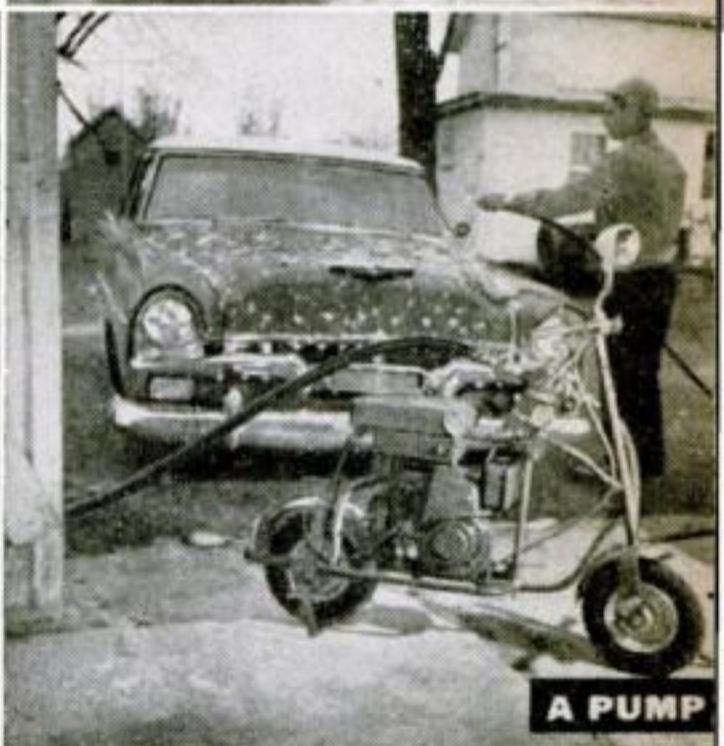
THIS SCOOTER ALSO POWERS ...



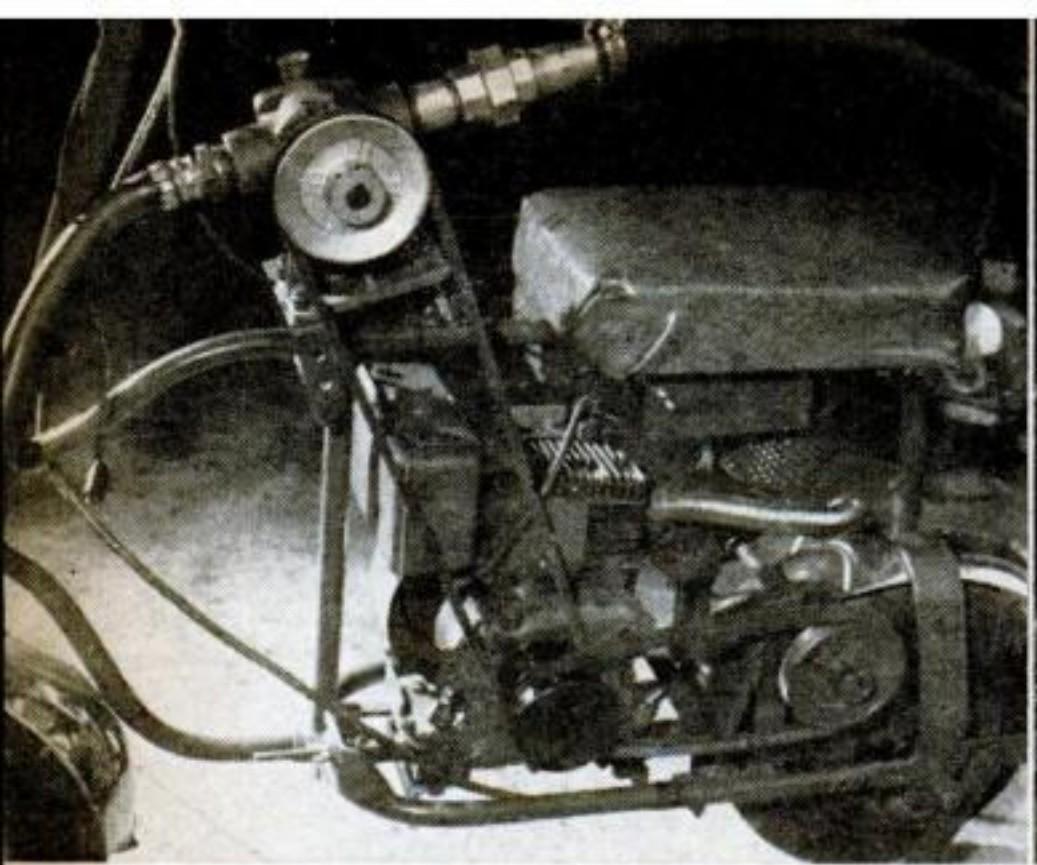
A HAULING TRACTOR



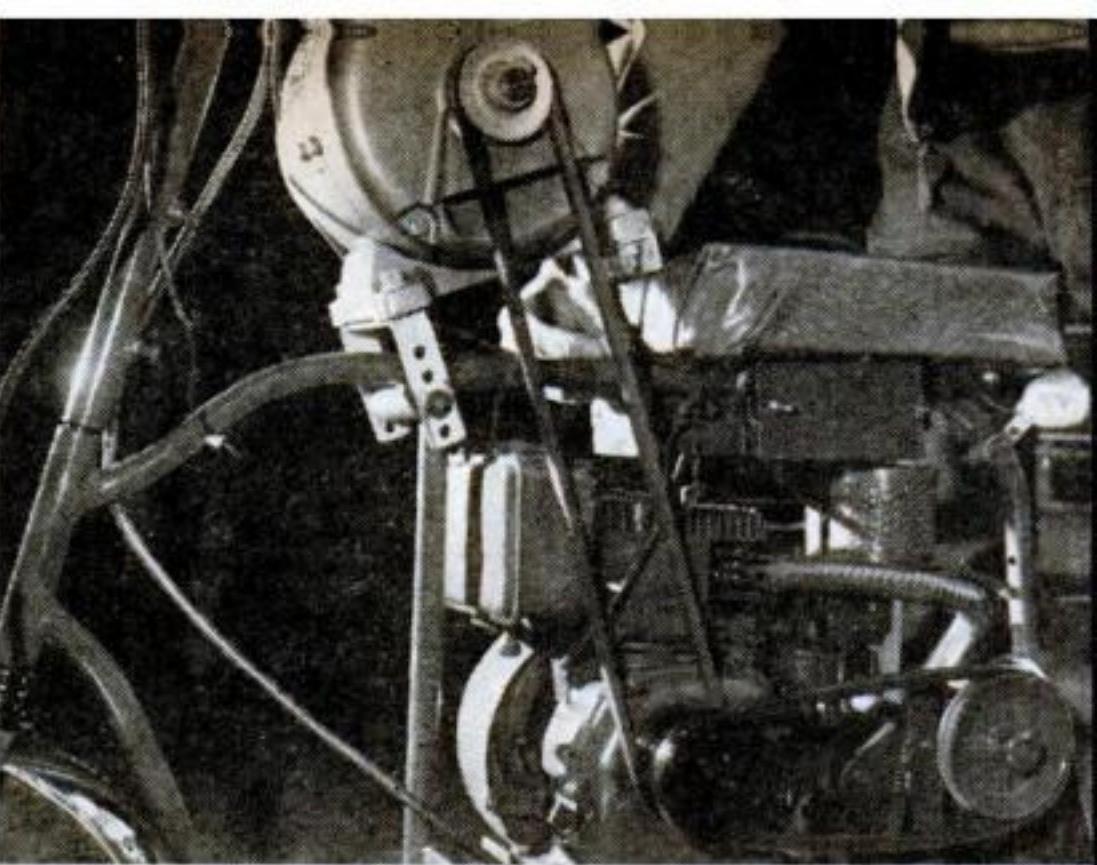
A SNOW PLOW



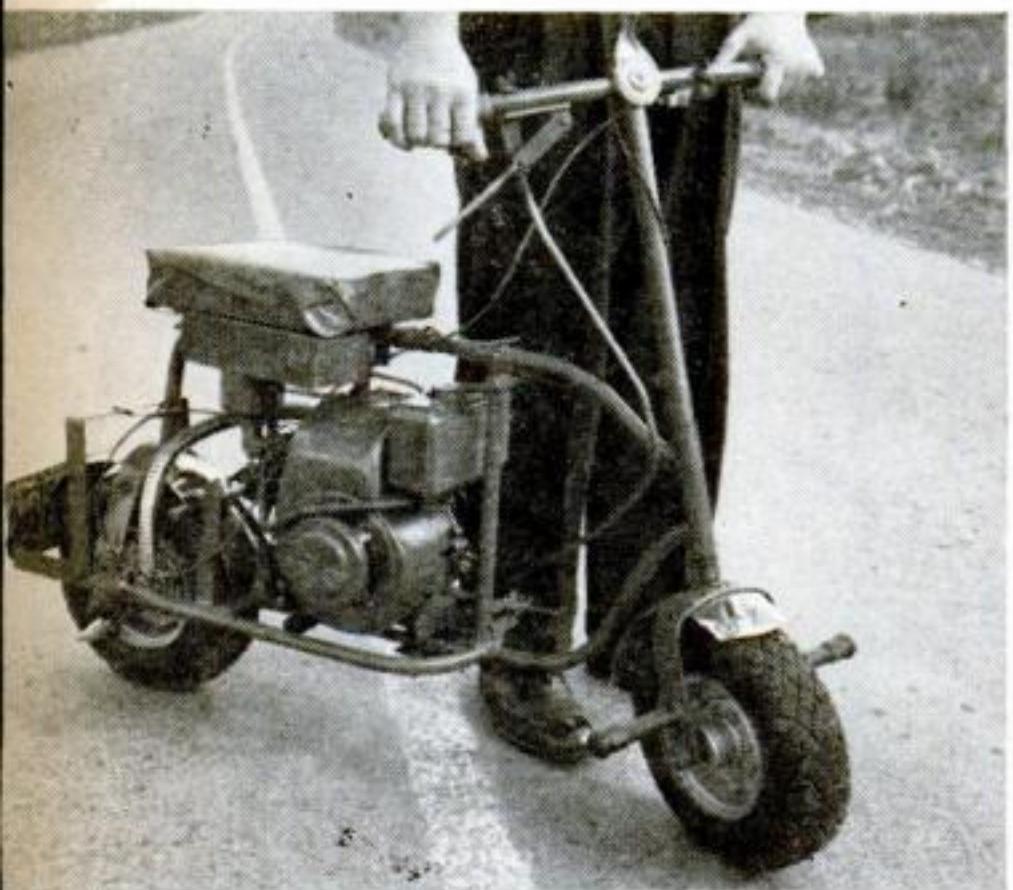
A PUMP



WATER FROM A CISTERN or any natural source can be brought to the job site by coupling the feed and discharge hoses to a 1,000-gallon-an-hour pump, powered by the scooter motor.



EMERGENCY LIGHT SOURCE is rigged by bracketing a 110-volt, 1,000-watt generator to the frame. It's propped on a bolt; turning a wing-nut pivots the assembly for belt tension.



LURE OF THE OPEN ROAD calls scooter from its chores. Since all attachments are complete in themselves, the scooter totes no extra burdens when stripped down for road travel.

SCOOTER CONVERTS TO MOWER in three steps: Auxiliary frame sets steering column vertical; mower unit replaces front wheel; large wheel replaces speed pulley in drive train.



1. The scooter. Biesecker obliged by jerking the four-cycle, three-horse motor to life and roaring out onto the road at 40 m.p.h. In a flash he was gone over the crest of a rise. Seconds later, he reappeared, banking back into the lane. He killed the motor, hopped off, and detached two levers from the handlebars.

"The throttle control is the standard type used on power mowers," he told us. "The cable's other end is connected to the carburetor throttle lever. The brake cable should be taped to the frame in several places, but I clamp it to the steering column so it's removable."

Next, he withdrew a long T-shaped pin that passes through the vertical pipe brace in front of the seat. The $\frac{1}{4}$ "-by- $17\frac{1}{2}$ " rod holds the ends of the steering-column braces in pipe-coupling sockets at each end of this brace. Biesecker lifted the scooter's separated halves into the trunk of his car. "Total weight's about 60 pounds," he announced.

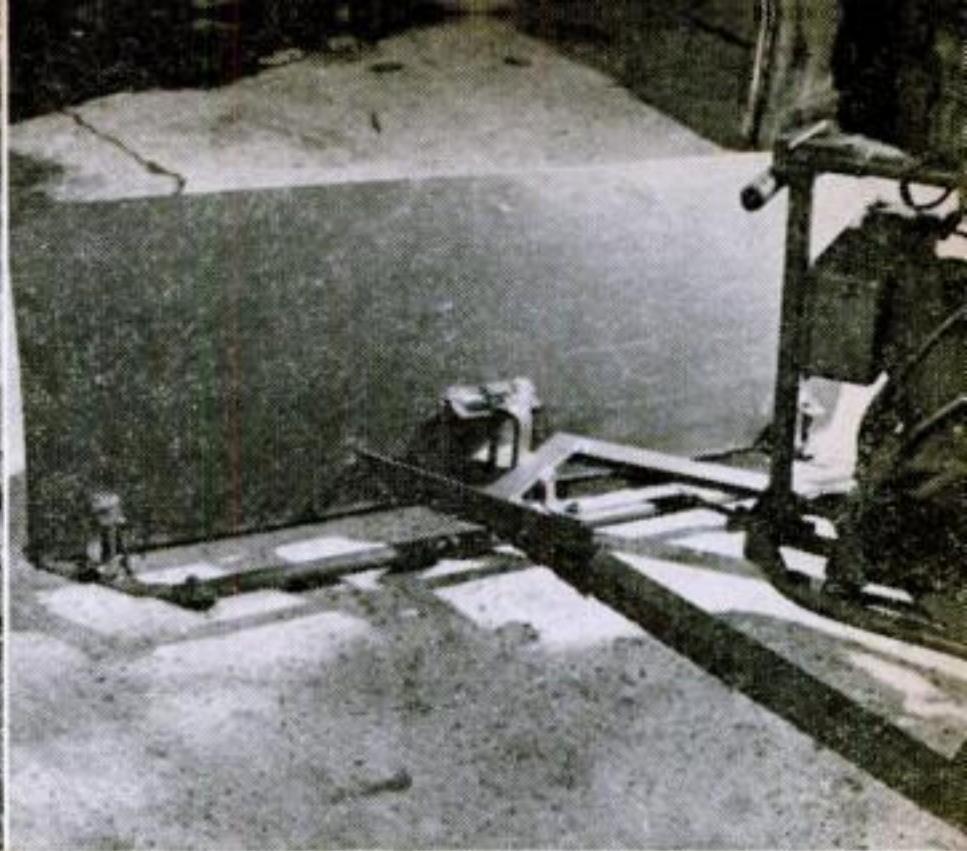
2. The pump. "While the scooter's in the car," said Bill, "why not drive back by the barn cistern and demonstrate your pump by giving the car a hosing?"

Biesecker had the setup nearly completed by the time Bill had his camera equipment ready. He'd reassembled the scooter, set it up on its kick stand, and bracketed a small pump to an accessory rest—which consisted of a short cross pipe with pins at either end. A bolt, projecting beneath the pump's mounting base, was seated in a hole in the frame brace



THE CART BED DUMPS for unloading dirt or rock. Biesecker's left hand is on the spring catch. The new steering column fastens to rear wheel bracket; scooter's front fork is removed.

in front of the seat. By turning a wingnut on this bolt, Biesecker pivoted the pump upward to put the proper tension on the long belt that connected it to the drive pulley. He fed a hose into the cistern and



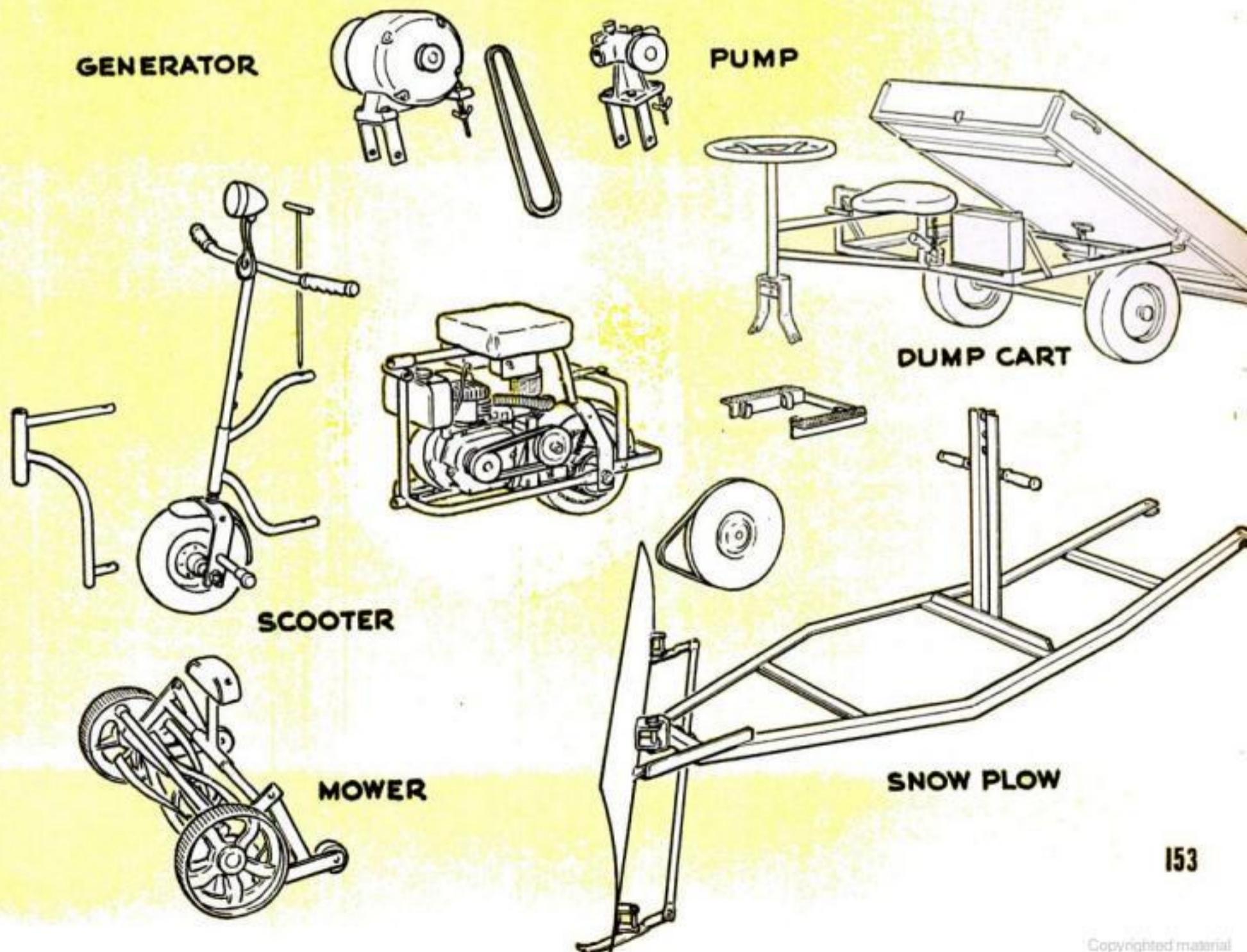
SNOW-PLOW BLADE pivots on frame for adjustment of angle; it is raised by lifting entire frame, which hooks onto steering-column cross-bar, and brackets to cart axle at the back.

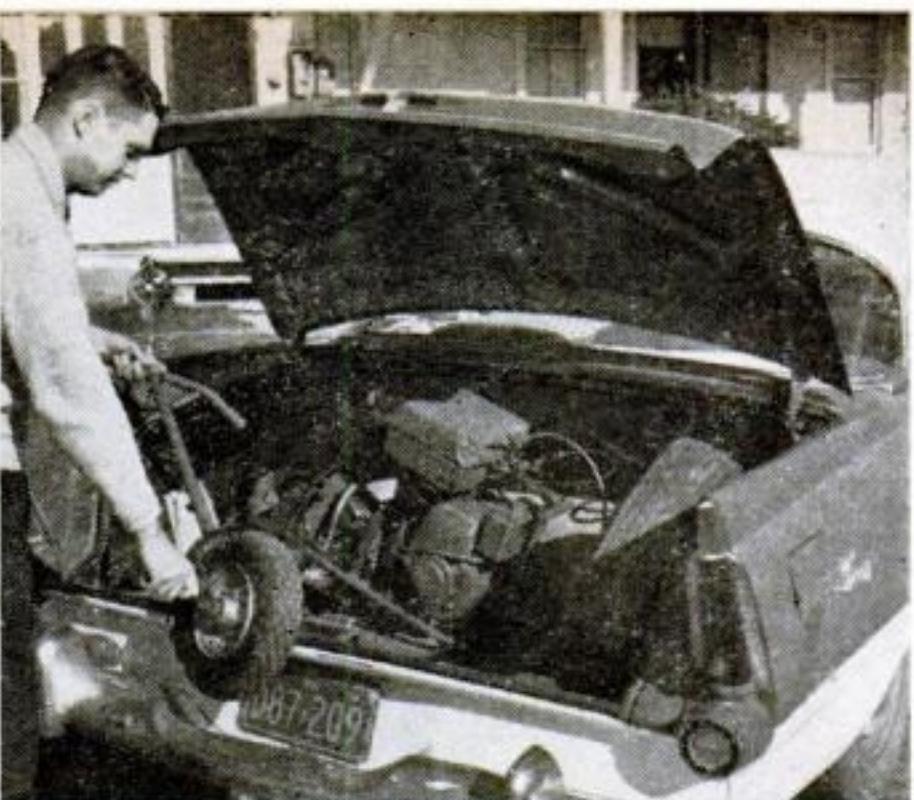
coupled the other end to the pump. Soon he was directing a sturdy spray at the soaped-up windshield.

3. The generator. We ran the dripping auto into the twilight interior of the

CONTINUED

How the power unit is used to make six different machines





TO TAKE IT APART for portability, you detach throttle and brake from the handlebar and pull a pin that passes through the center frame

barn. Biesecker set up a photographic light bar and replaced the pump with an electric generator equipped with an identical mounting bracket and adjustable prop-bolt. After starting the scooter motor again, he lifted the car's hood and directed the light exactly where he needed it to work on the engine.

"Actually," he said, "this portable generator is handy in lots of places beyond the reach of city power. I've used it for outdoor photography, night repair work in the fields, and even to rig a light for a hunting camp. It's handy in case of power failure."

Biesecker detached the generator. The coupling pin was pulled once more, and the scooter began to lose its identity.

4. The mower. To ready the power unit for its next function, the high-speed drive pulley was replaced with a power wheel of twice the diameter. The axle nuts were loosened to drop the front wheel from its slotted fork.

Nearby lay a handleless lawn mower and an extra section of pipe frame. Biesecker loosened two studs threaded through the handlebar column and slipped this upper unit off the steering shaft. "All shafts are cold-rolled steel," he informed us. "This one's $\frac{3}{4}$ " in diameter and $13\frac{3}{4}$ " long. Note how I filed it flat in two places at the back to seat the studs." He slipped the angled steering-column housing up off the shaft and pointed out the coil spring that it had rested on, where the shaft was welded to the wheel fork. "That spring stays," he

brace. This releases the ends of the steering-column braces from their coupling sockets. Both halves fit neatly into a car trunk.

said, slipping the new frame down to butt against it. I had a question:

"Why's the separate frame necessary?"

"To set the steering column vertical. The scooter's column slants at 15 degrees, but the mower's has to set upright. Notice how all the pipe-column housings are slightly counterbored at each end to take brass bushings. These are pressed in tight to support the shaft."

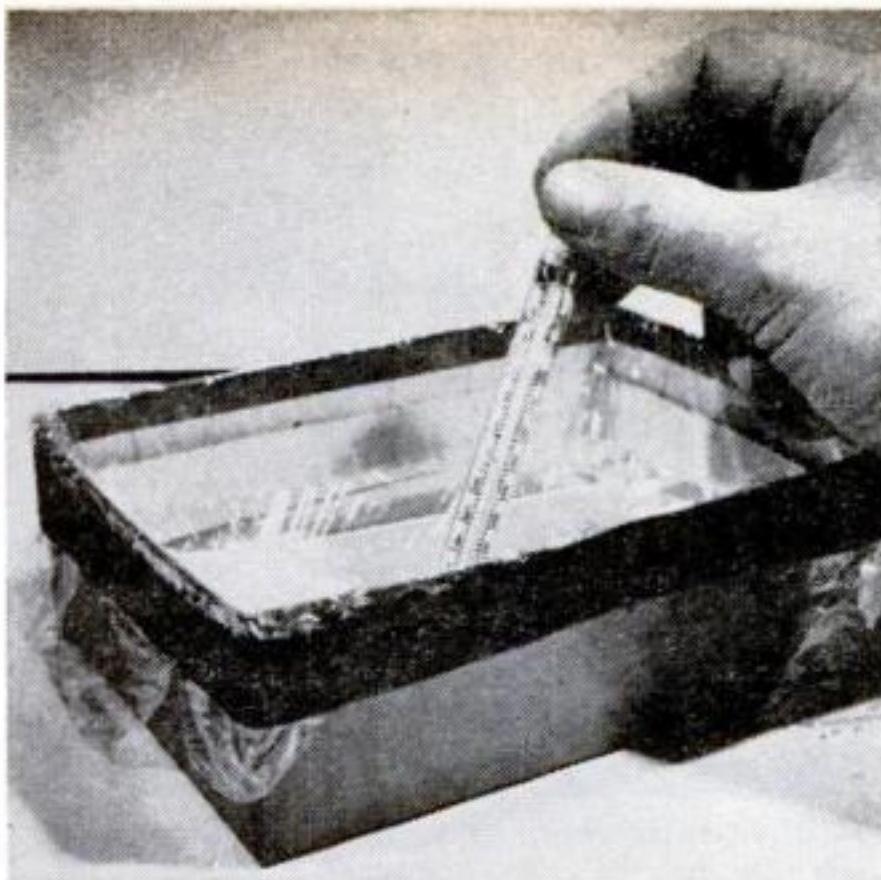
He replaced the handlebar column, retightened the studs, and reconnected the brake and throttle levers. Then he wheeled the mower unit into place, pivoting its mounting bracket up to bolt it into the wheel-less fork. "I leave the mudguard in place since it doesn't interfere with mowing. The mudguards are merely a standard bike fender cut in half."

With the inventor aboard, the little tractor-mower moved out across a wide stretch of grass, maneuvering around several fruit trees and running close along a hedge.

5. The dump cart. This time, when the coupling pin was withdrawn and the frame pulled apart, the front steering column was discarded. Instead, a new vertical column, welded into the frame of a two-wheeled cart, was bolted onto the fixed fork of the rear wheel. Only the back half of the scooter is used in this conversion, and the power wheel becomes the front wheel of the cart tricycle—which is steered by pivoting the entire power unit.

A U-shaped auxiliary foot rest is hooked onto the scooter frame behind the kick-

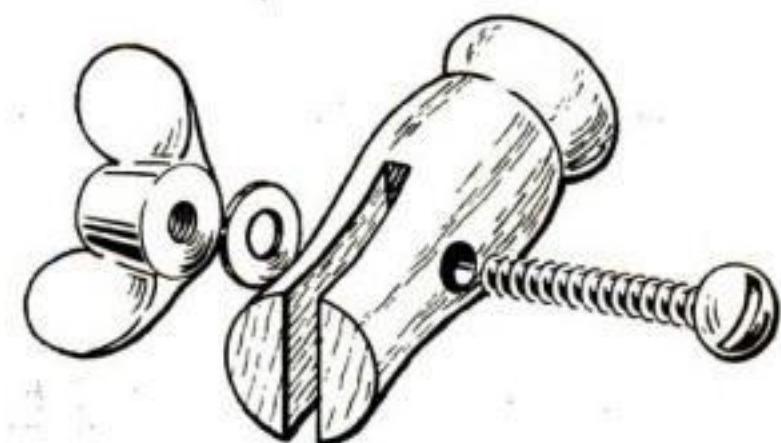
[Continued on page 202]



Temporary Tanks from Boxes

NEED one or more trays in a hurry for printing snapshots, washing parts, or housing the goldfish temporarily while you clean the aquarium? Make your own. Any cardboard box, or the lid, lined with plastic food wrap, will hold liquids.—*Edward Shallcross, Drexel Hill, Pa.*

Short Cuts and Tips FROM PS READERS



Clamp from a Clothespin

A USEFUL hand vise can be made from an ordinary wood clothespin in less than a minute. Cut off the tapered ends of the clothespin and drill a hole through it for a bolt. A wingnut and washer make it easy to tighten the jaws by hand.—*Daniel Bousha, Jackson, Mich.*

My Most Embarrassing Shop Moment

OUR submarine had just surfaced to make emergency repairs when I, a proud new electrician's mate, was summoned to the bridge. I was informed that the starboard running light was inoperative and that I had exactly one hour to fix it before we would be required to submerge.

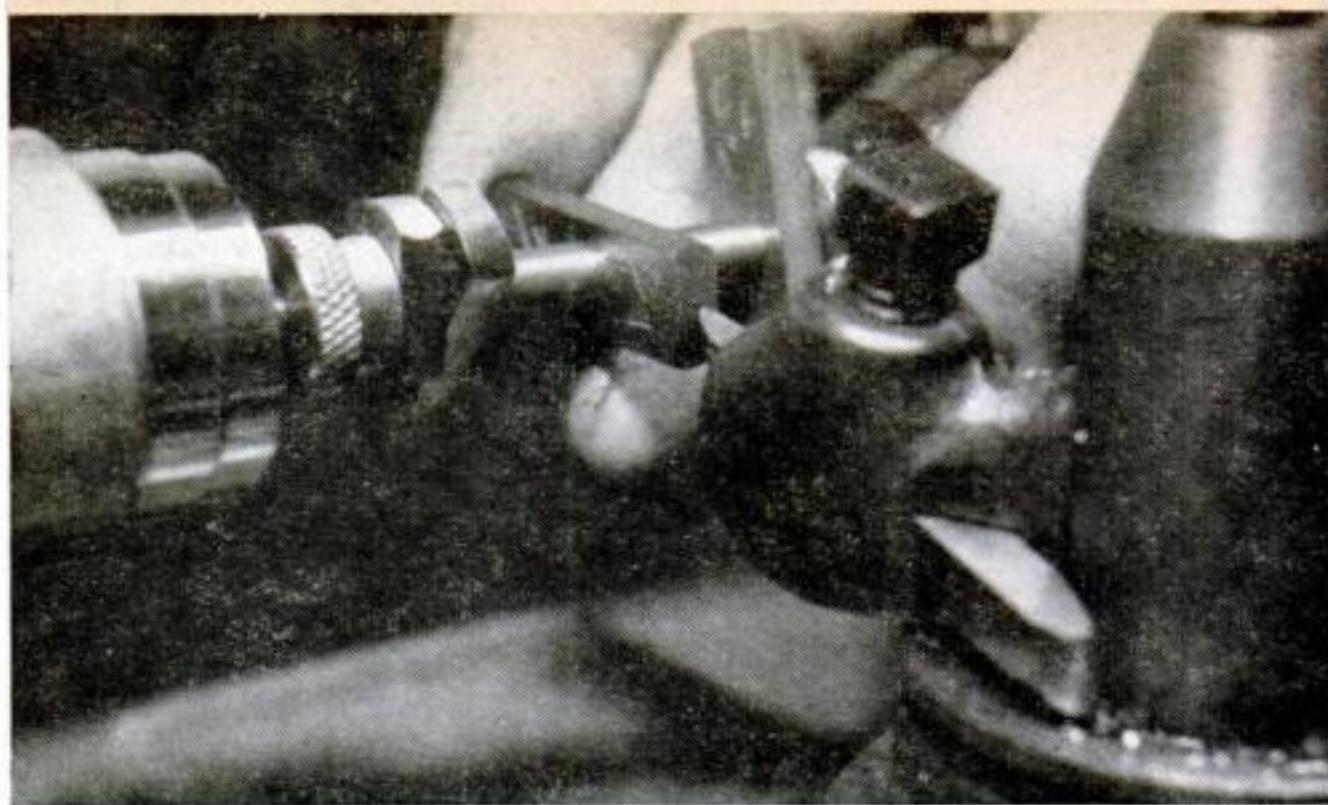
I hurriedly gathered tools and a spare bulb, put them in a box, and went forward on the double. It took me 40 minutes to drain sea water from the flooded lamp housing and dry out the cable. Then I spent another 15 minutes making the housing watertight again. Finally, I had everything squared away. With only seconds to spare, I secured the last bolt and dashed back to the bridge.

The officer of the deck congratulated me on the fast repair just as the warning signal to dive sounded. As I headed for the hatch, beaming with pride, I opened the box to replace some tools and there it was—the new



light bulb that I was supposed to put in. Luckily, we were able to remain surfaced a few minutes longer while I put in the bulb, but you can bet that they were the longest minutes in my life.—*John L. Flowers Jr., EM 2/ss, U.S.S. Trumpetfish.*

One MACHINIST tells another...



TO SET THE TOOL to turn standard diameters, simply advance the bit until it touches the proper gauge.

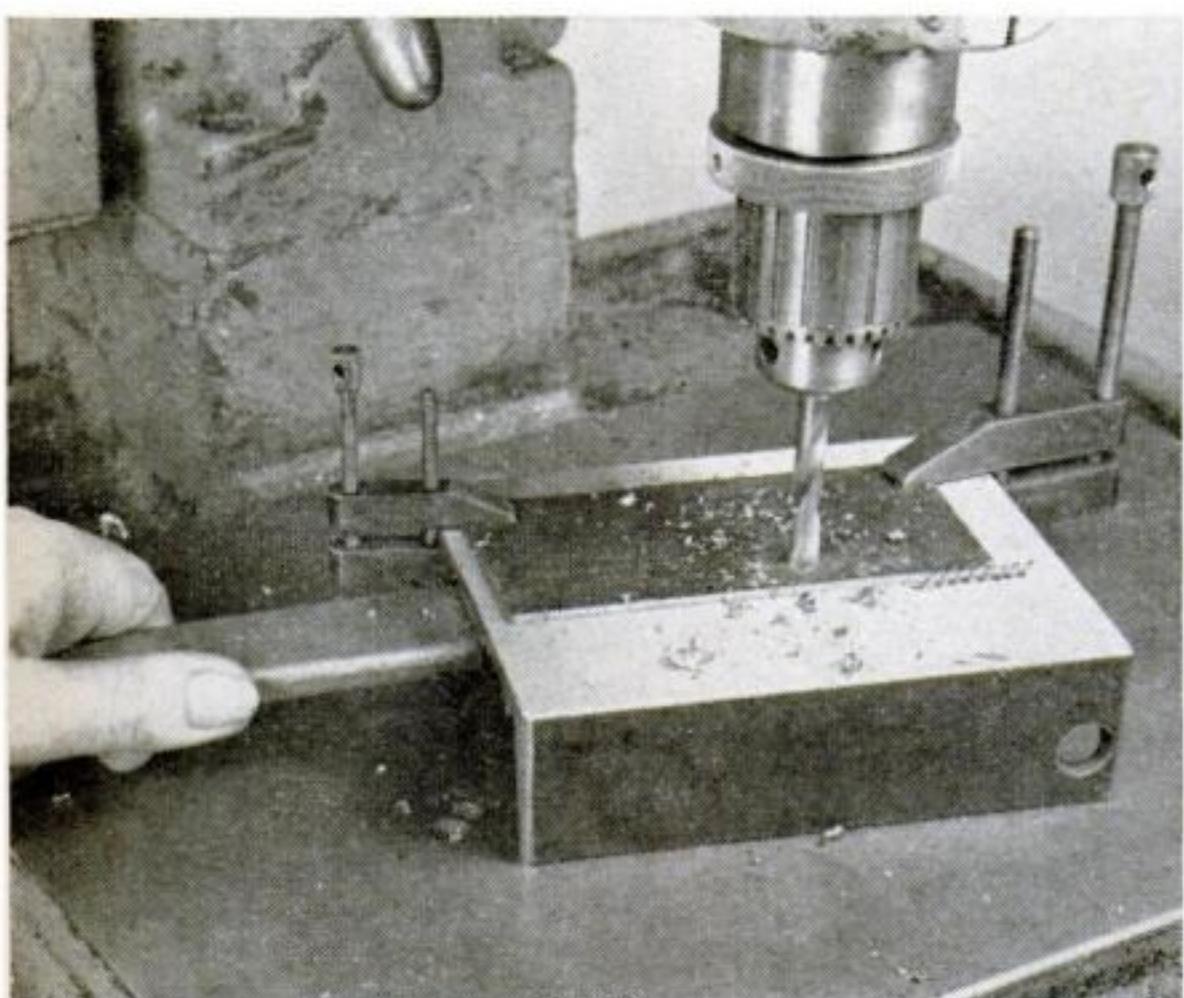
. . . Gauge Speeds Turning

You can machine stock to dimension quickly and accurately with this easily made lathe accessory. It will eliminate the series of measurements usually necessary when reducing stock to a desired diameter.

To use it, you simply chuck the spindle of the gauge assembly in the tailstock, bring the tool bit up to the appropriate gauge, and note the reading on the cross-feed micrometer collar. This will be the reference point for the final cut. When setting the reference point, advance the

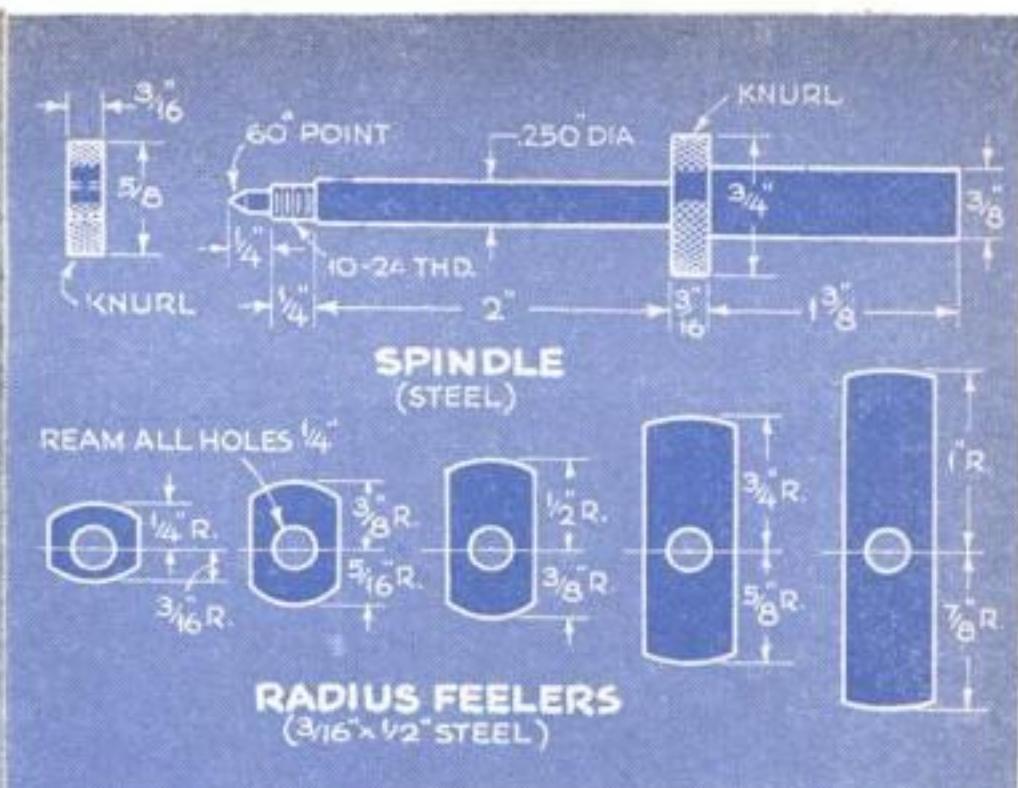
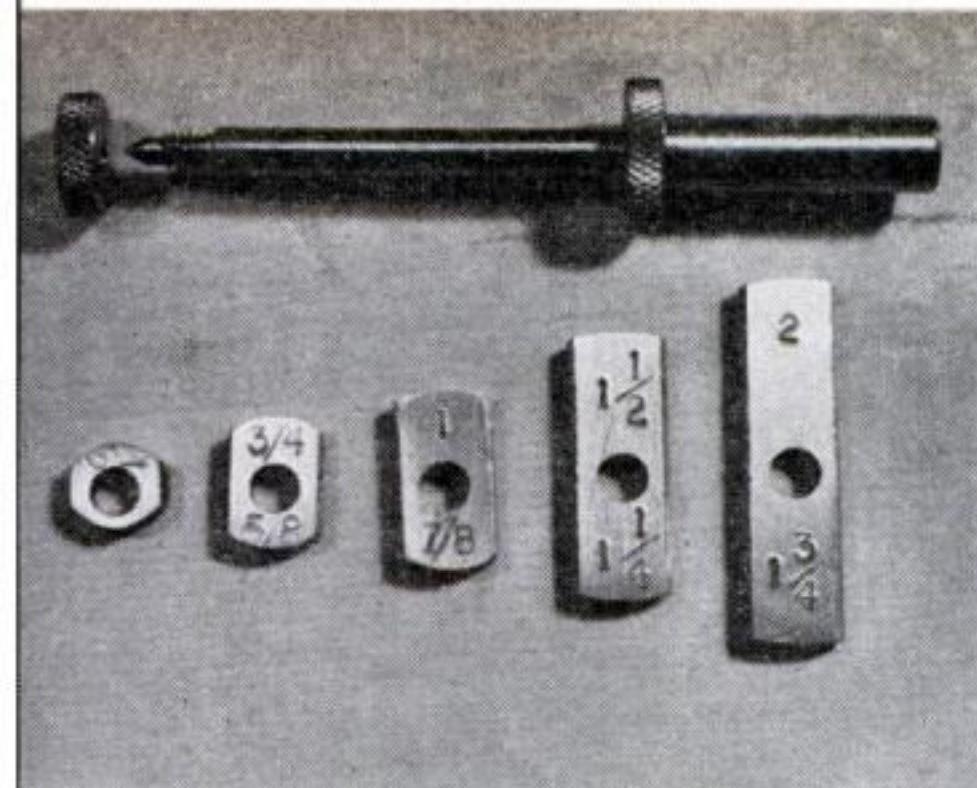
crossfeed screw until it just touches the feeler gauge. Don't back off the screw, or play in the nut will cause an inaccurate setting. Follow the same procedure in setting crossfeed for final cut.

The spindle will accommodate up to six feeler gauges, giving you a choice of 12 different diameters. Turn the spindle between centers and knurl before finishing the $\frac{1}{4}$ " spindle shaft. Leave the $\frac{1}{4}$ " shaft about .001" oversize and polish to fit the reamed holes in the feelers later. Cut threads and 60-degree point after



Here's a Better Way to Drill Thin Stock

HANDIEST workholder in our shop is a piece of steel channel with a handle welded to it. Thin work, which is usually difficult to clamp to the table or hold in a vise, is easily secured and fully supported. Also, the drill-press table is protected from being drilled into accidentally. For accurate work, it is desirable to plane or surface-grind the top surface and bottom edges of the channel after the handle has been welded on.—*H. J. Gerber, Stillwater, Okla.*



RADIUS GAUGES can be made for any number of different diameters and used individually or

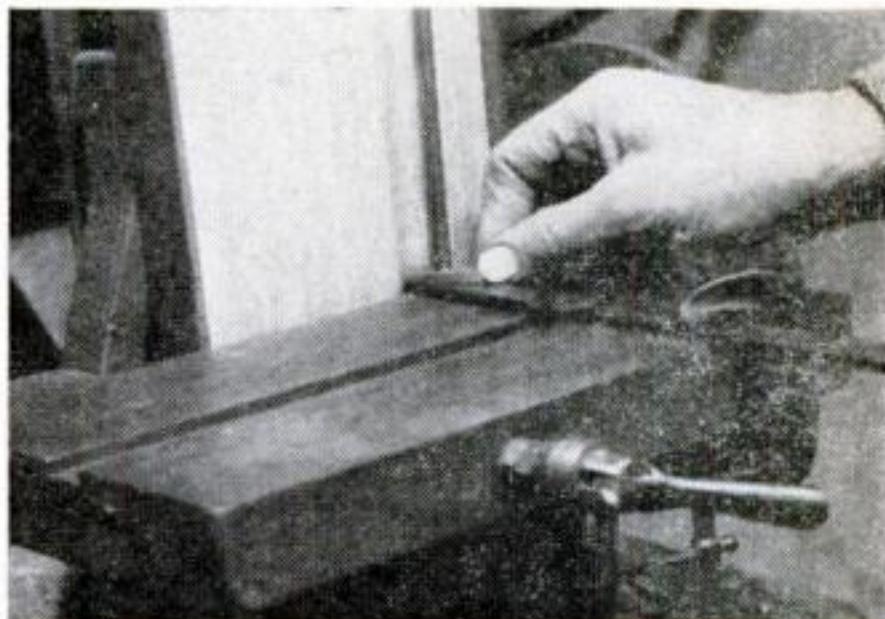
stacked on the spindle for quick use when a job calls for several different diameters.

Stock to Size

machining. The point is used to set tool-bit height.

Cut feeler gauges from $\frac{1}{2}$ "-by- $\frac{3}{16}$ " flat stock, prick-punch, and scribe an arc for desired diameter with dividers. Drill and finish with a sharp reamer.

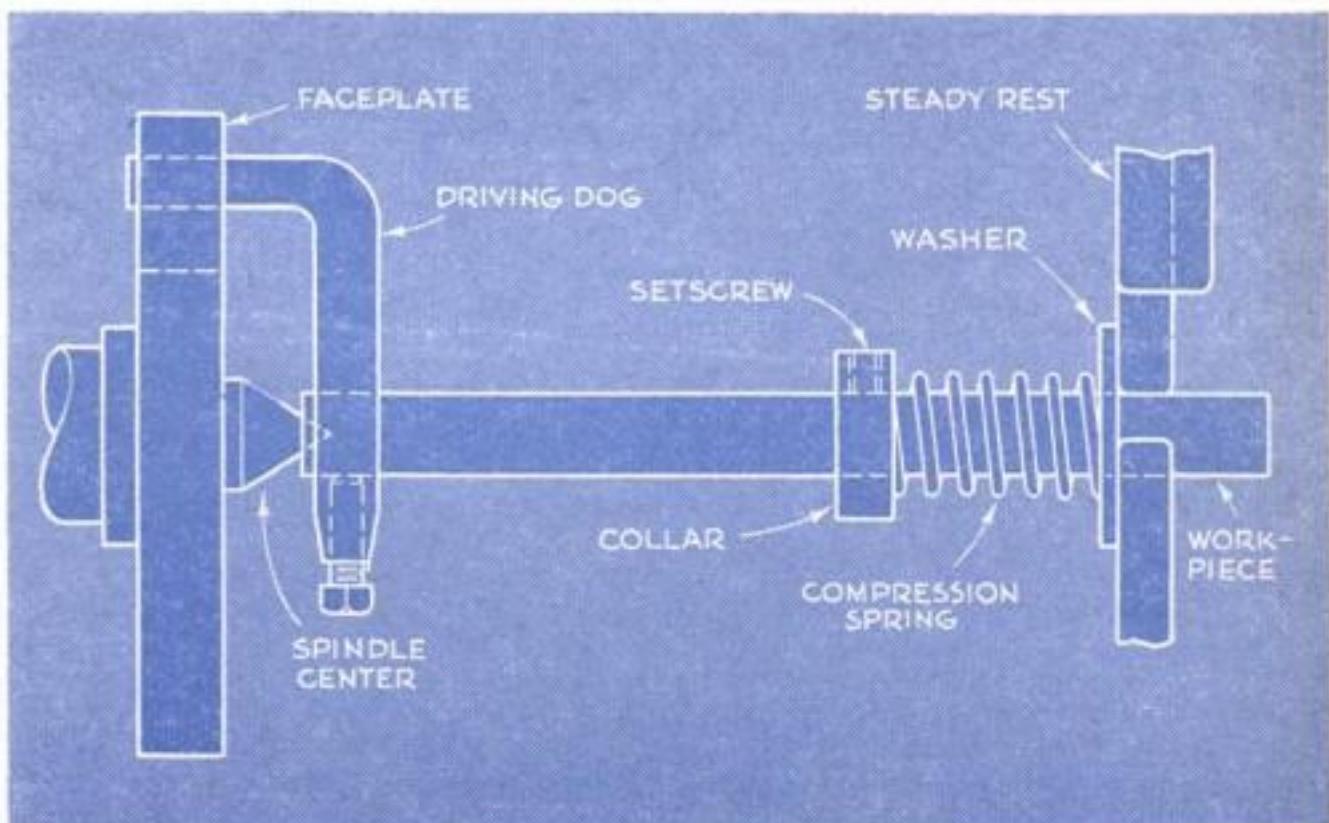
Make a simple jig to grind the gauges to size. Drill a piece of flat steel stock near one end and insert a short $\frac{1}{4}$ "-steel dowel. Use this as a pivot to grind the gauges down to the scribed line. Use a vernier caliper to check as you grind.—*James McKinney, Englewood, N. J.*



GRIND GAUGES to proper radius on a belt sander or grinder. Jig will let you pivot the gauge as you grind to produce accurate radius.

Spring Holds Rod in Lathe

LATHE work supported in a steady rest at its free end is usually held back against the spindle center by binding leather straps around the driving dog and faceplate. This is not only bothersome but it can result in pressure that is not in line with the center of the work. Here's a timesaving method that assures centered pressure: Slip a snug-fitting spring over the work and compress it between a washer placed

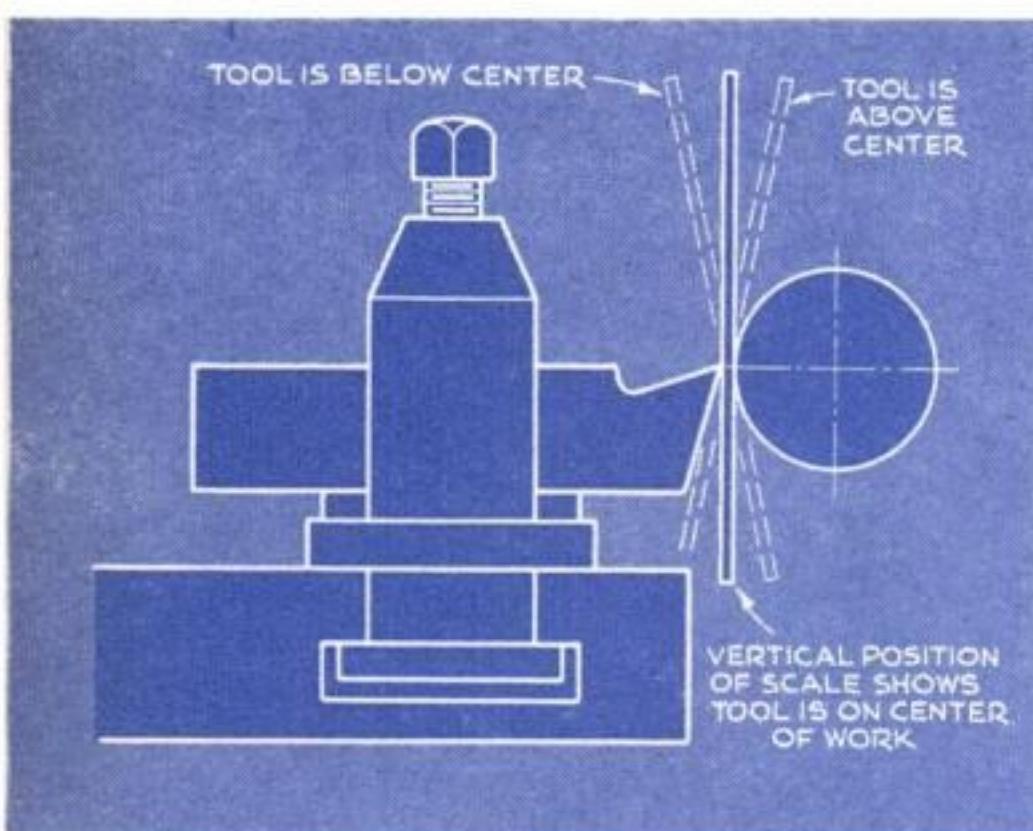
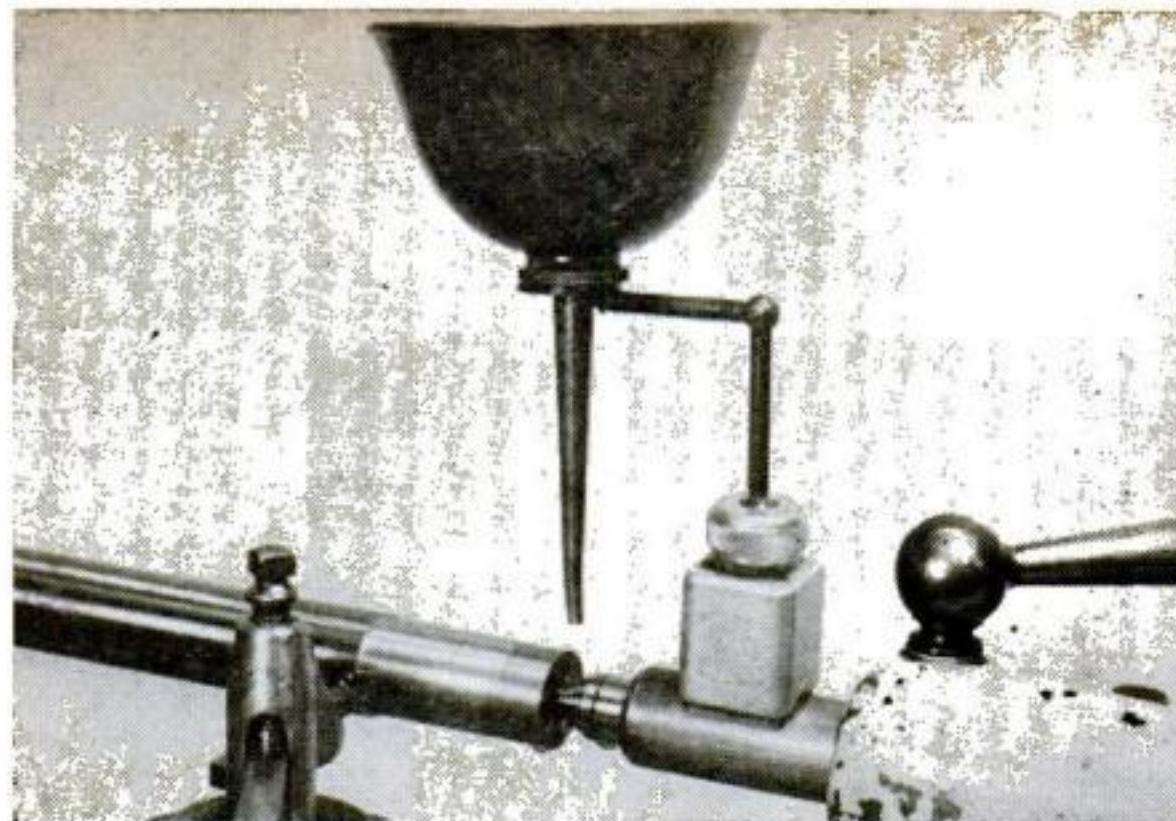


against the steady-rest jaws and a collar held on the work by a setscrew.—*M. W. Loftus, Chicago.*

CONTINUED

Protect Centers from Running Dry

CONSTANT lubrication of a lathe tail center is assured if an oil can is suspended as shown. The support is one of the commonly used magnetic indicator bases seated on the tail spindle. A steel washer soldered to the swivel arm of the base provides a ring support through which the spout of the oil can is inserted.—*H. J. Gerber, Stillwater, Okla.*



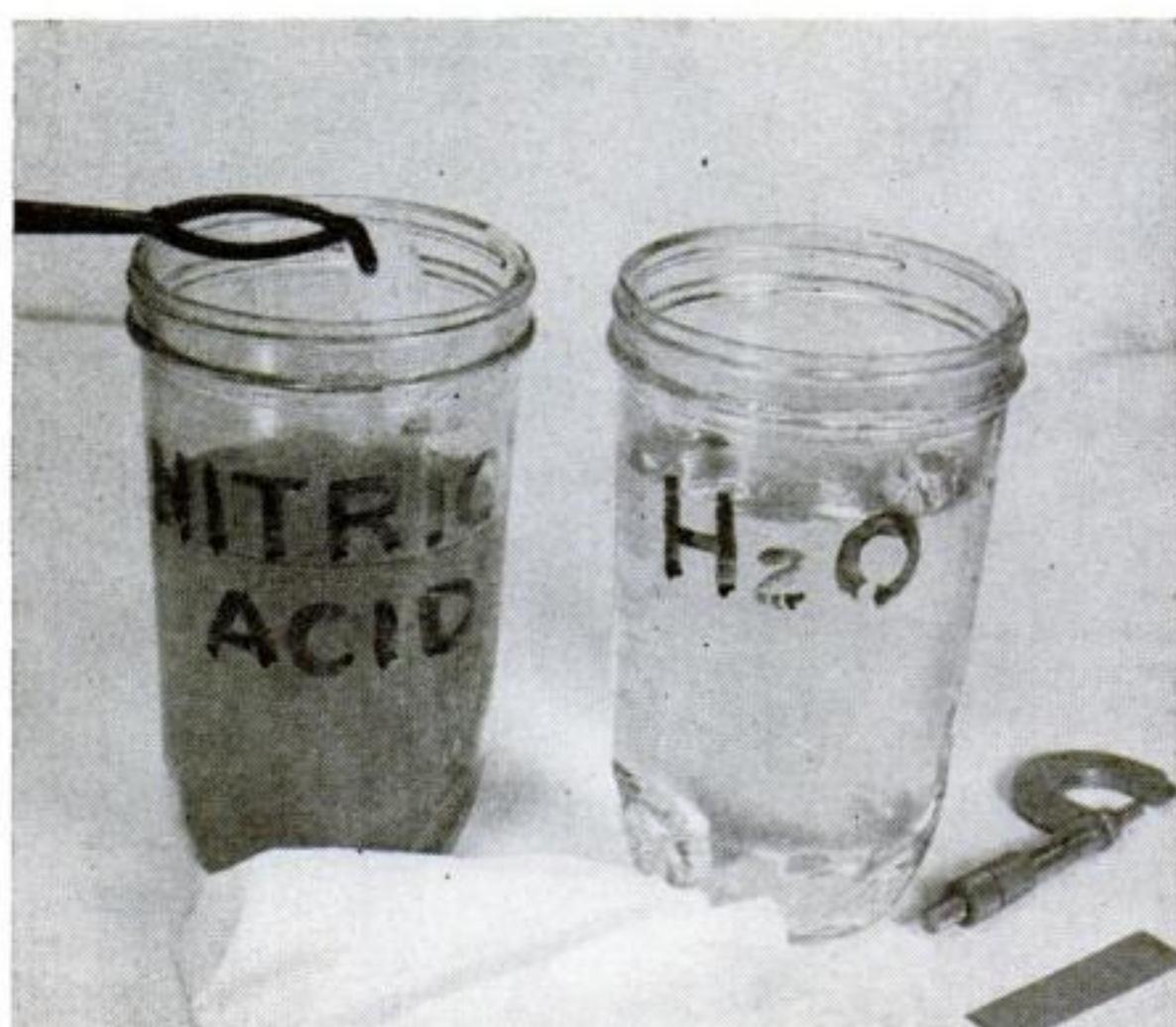
Setting Up Lathe Tools

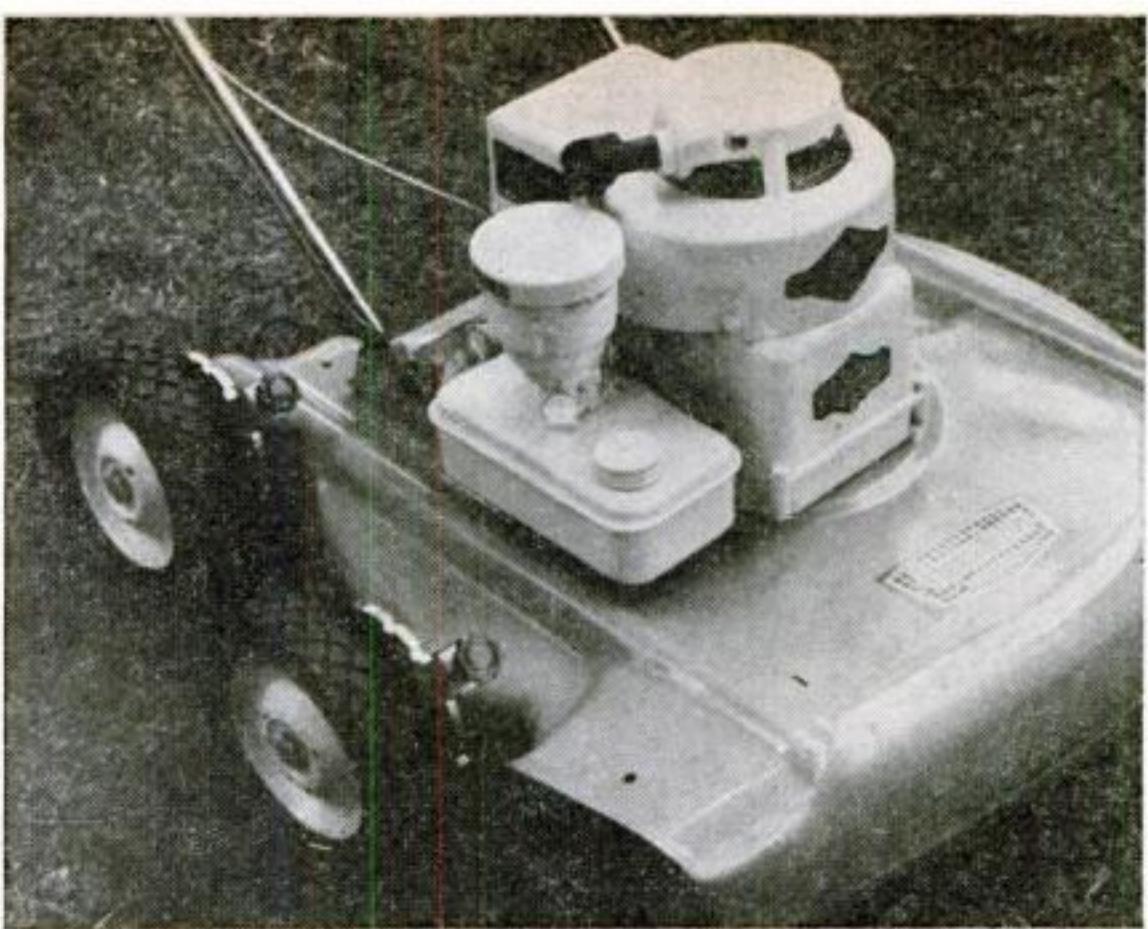
AN EASY and accurate way to set the cutting height of a lathe tool is to place a machinist's scale (or other thin strip of steel) against the work and advance the tool until it presses hard enough to hold the scale. If the scale assumes a vertical position, the tool is on center. If it is above or below center, the scale will tilt as indicated by the dotted lines shown on the drawing.—*M. W. Loftus, Chicago.*

Acid Etch Thins Sheet Brass

I OFTEN need brass shims or flat springs of a particular precision gauge. Since I have no rolling facilities, I immerse standard brass shim stock in a nitric-acid etch for a minute or so, rinse it in water, and check the thickness with a micrometer.

It may take several dips—trial and error on a scrap will show the rate of reduction in thickness. Be sure to allow extra length so you can discard the portion that is gripped by the forceps.—*H. J. Gerber, Stillwater, Okla.*





**You just pull a knob
and these—**

Mower Wheels Flip to Vary Cut

TO VARY the height on most mowers running up and down lawns today, it's necessary to remove and reset all four wheels—a nuisance to most people.

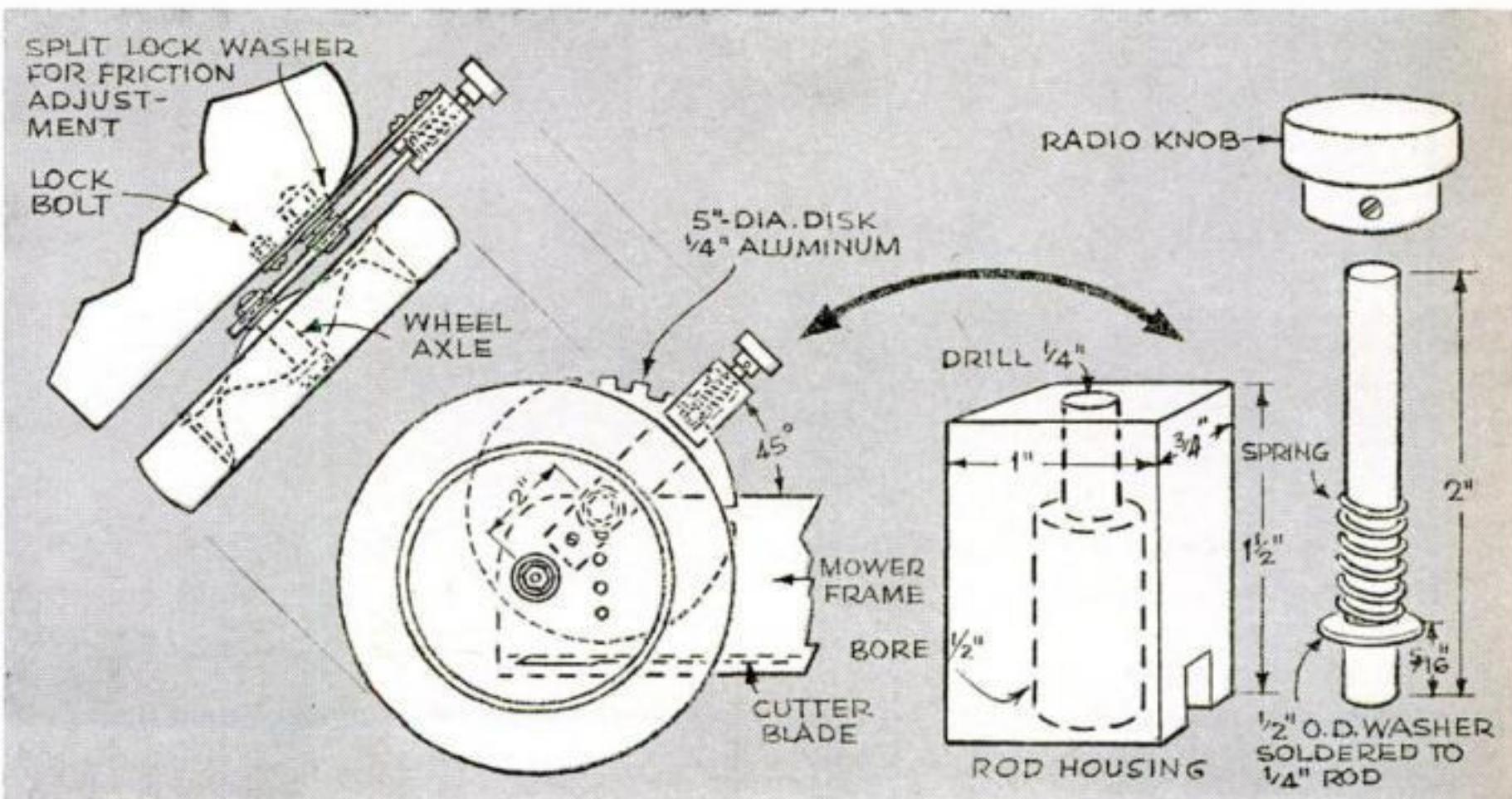
You can add the quick-adjustment feature of the '61 models to your mower by mounting the wheels on rotating disks as shown. Changing cutting height will then be a simple matter of pulling a stop knob, turning the disk to swing the wheel to a new level, and letting the stop drop into a notch in the disk.

Cut the disks from $\frac{1}{4}$ " aluminum and mount the wheel axles in holes drilled 2" from the center. Bore blocks of scrap brass or steel to house the stop rod and

a light spring. Fasten the blocks to strips of aluminum or steel so that they straddle the disks as shown below.

Use a bolt in the highest axle hole in the mower frame to fasten each disk and steel strip in place. Set the steel strip at 45 degrees to the frame, and lock in position with a second bolt.

Locate the notches in the disks by blocking up the mower's frame at various cutting heights with the wheels resting on the bench. Mark the stop positions on the disks and file $\frac{1}{4}$ " notches. Scribing the cutting height beside each of the notches will speed the adjustment.—*Joseph G. Karnath.*



No-Walls Carport Stands on Angle Iron

IT TOOK me only three days to erect this 20'-square shelter for my car and trailer. It's covered with two sheets of 29-gauge corrugated steel, joined at the ridge with a 14"-wide galvanized flashing strip. I used 1½"-by-1½"-by-1/8" angle iron for the posts (and four back braces) and 5/4"-by-6" boards for the roof framing; 1/4" cables with turnbuckles connect the roof corners. Total cost of materials: \$85. I've sold and installed a number of these units locally.

An earlier, less-permanent model (not

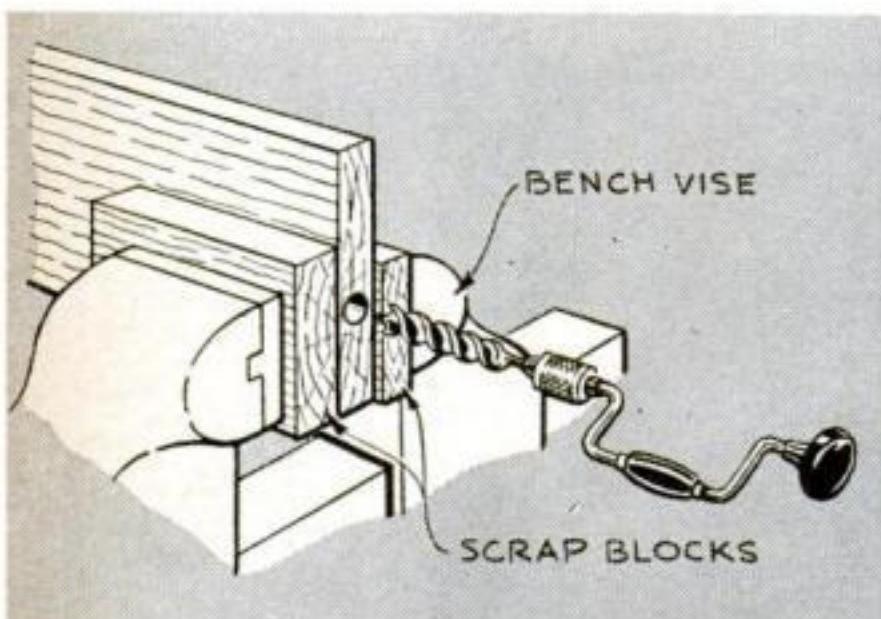
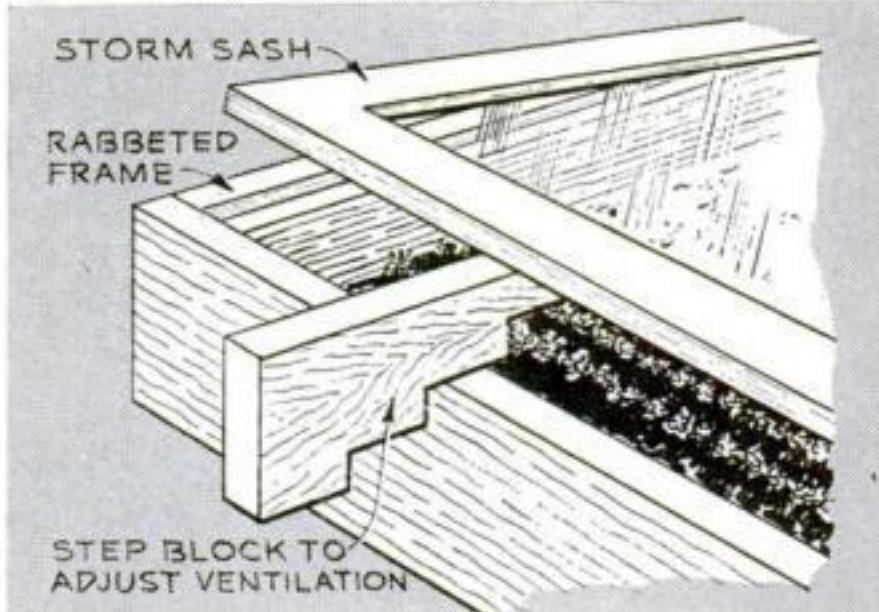
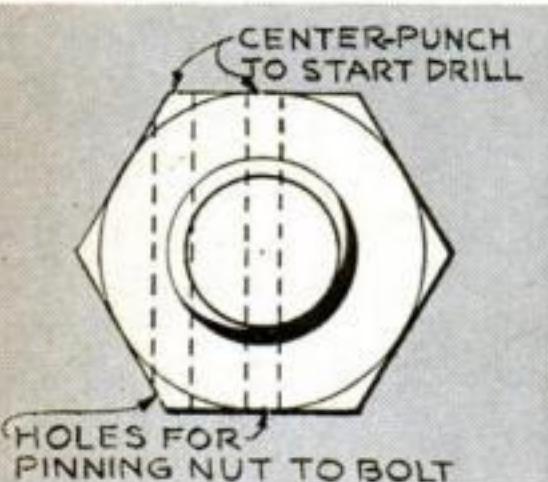


shown) was covered with a single sheet of 5-mil polyethylene, fastened only at its rolled edges. Two-by-two posts, set in concrete, supported a frame of two-by-twos and one-by-sixes, braced with cables. This plastic-roofed version cost only \$28.

—Charles L. Gay, Fairhope, Ala.

Nut Helps You Cross-Drill a Bolt

DRILLING threaded bolts—even small ones—is no trick if you tighten a nut on the bolt first. That way, you can center-punch one of the flats on the nut and drill through both nut and bolt. If the bolt is of large diameter, drill a cotter-pin hole through the side, rather than the center of the bolt. This won't weaken the bolt nearly as much as a center hole would. The hole need go only through the thread.—F. L. Trudeau, Tweed, Ont.



Prevent Splitting End Hole

WHEN the hole to be drilled in the edge of a board must have a diameter nearly equal to the thickness of the board, clamp a scrap block on each side to prevent splitting. Drill slowly.—Warren E. Greenwald, Cincinnati, Ohio.

Cold Frames from Storm Sash

COLD frames for early spring planting are easy and cheap to set up, once you've removed your storm windows. Either wooden or aluminum sash can be dropped into rabbeted frames. You don't even need to hinge them.—Ken Murray, Colon, Mich.

know-how file

**The latest techniques
for installing—**

Rigid Plastic Counter Tops

A SLICK-LOOKING, plastic-topped counter is the making of a kitchen. Yet installing plastic laminates is a job that's often bungled, or avoided completely for fear of bungling it. It's a job that's worth doing well; the results can be magnificent. Difficult? Not really. But it does take patience and technique.

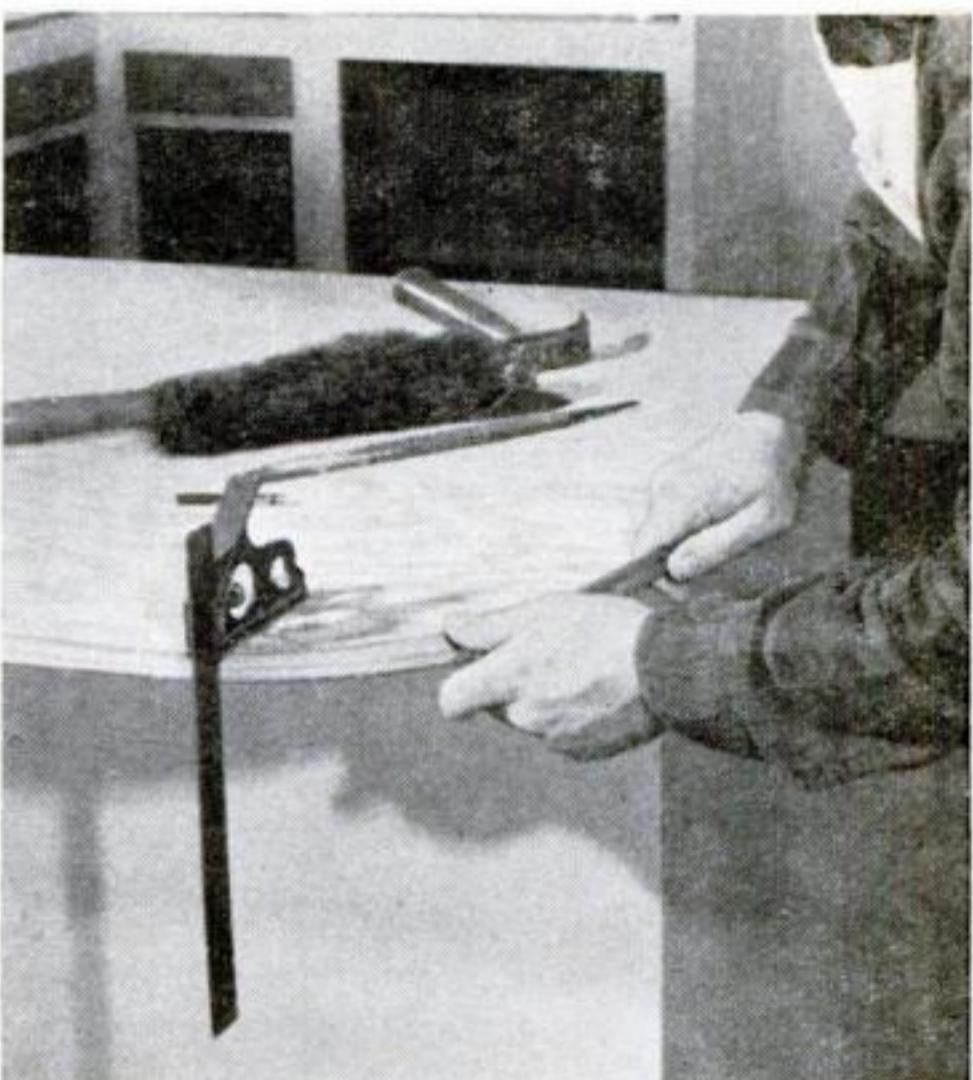
The method shown in the accompanying photos is the result of years of professional experience. It incorporates three modern advances in the technique of counter-topping:

- **Self-edging**—covering the exposed edges of a counter with the same plastic laminate that goes on the top—is now an easy job with special tools. It not only eliminates the need for separate metal edgings, but it gives the counter a rich, clean appearance with no ridges to collect food particles and moisture. The development of self-edging has also made it possible to cover coffee tables, vanities, bar tops, and other furniture without the "kitcheny" look of metal-edged surfaces.

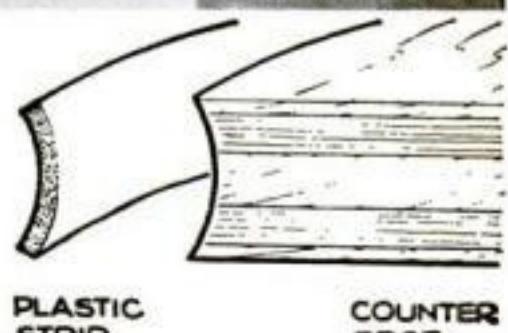
- **The wall-mounted backsplash** provides a clean, tight joint between counter and wall, and eliminates the separate wood backsplash that formerly had to be fastened to the



1. TOENAIL THE COUNTER TOP into wall studs first. This step, often overlooked, prevents the counter from pulling away from the wall if the floor joists later shrink and the cabinet settles.

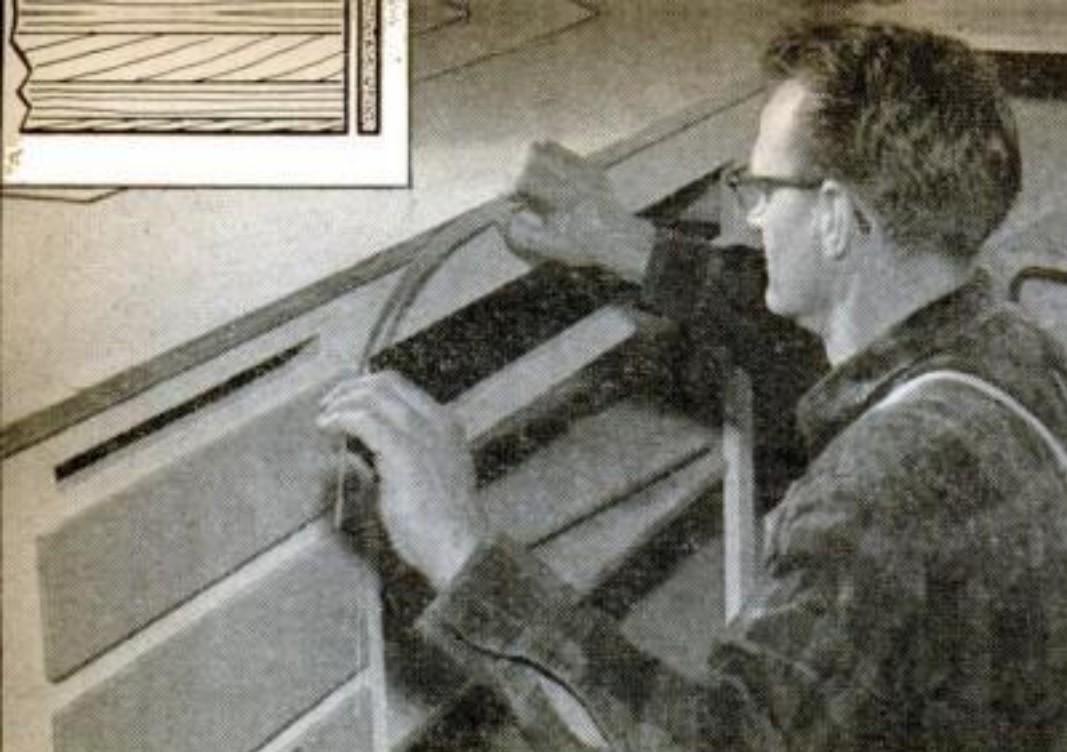


2. CURVED EDGES should be filed slightly concave. This allows the plastic facing strip, which takes on a concave shape when bent, to seat itself snugly against the edge.



CONTINUED

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3. EDGE STRIPS GO ON FIRST and are overlapped by counter covering. Cut strips slightly oversize and use your thumb to line up their lower edge flush with bottom edge of counter.



4. HEAT EDGE STRIPS that curve to make them flexible. Hold them over an electric range or infrared heat lamp, but not an open flame. Heat should not exceed 250 degrees.

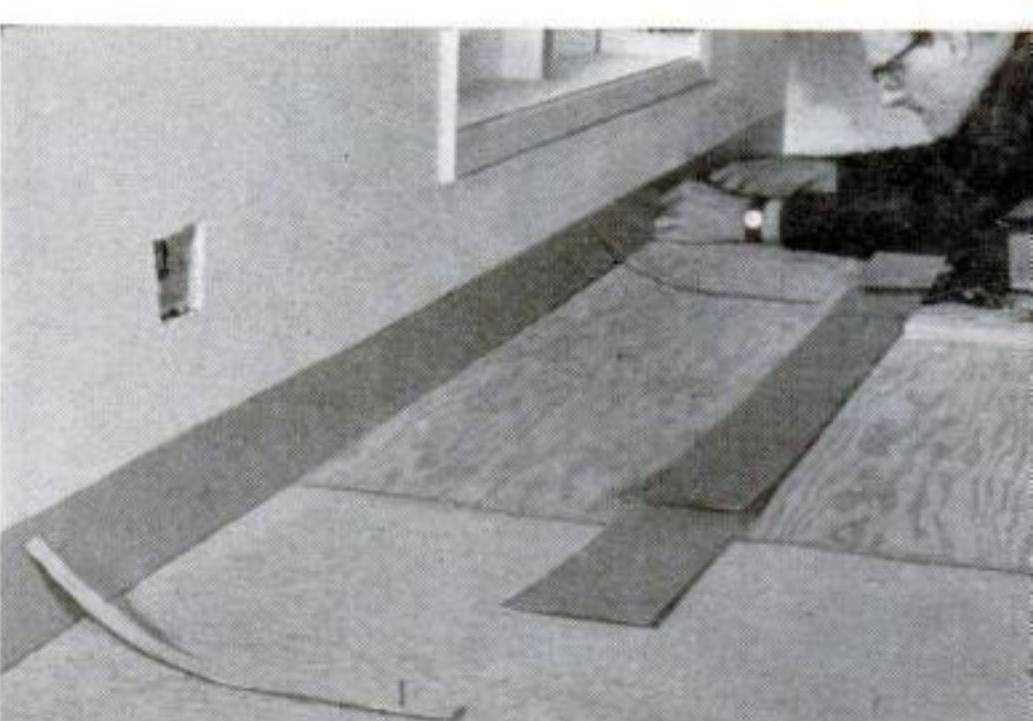
counter before the counter was installed. For this, special metal cap and cove moldings are available to frame the backsplash. You simply nail them to the wall and counter and attach the laminate with cement.

• **Using a router** is the secret of a fast, slick job. You can rent one from hardware stores, counter-covering dealers, or tool-rental shops. It will usually come as a kit with three special bits—one for trimming the self-edging, one for cutting matching seams, and one for final beveling of the counter edge.

In working with contact cement, remember that both surfaces—counter and laminate—must be coated and allowed to dry, and not be permitted to touch until perfectly aligned. They bond instantly and can't be pulled apart. Test-fit all pieces first to be sure they're accurate. The wood counter (especially the porous edges) may require several coats. If dull spots show up after the cement has dried, use more cement.

The laminate can be cut best with a saber saw, but you can also use a jigsaw, circular saw, or handsaw. In using a handsaw, back up the laminate with a board to keep the thin sheet from cracking. Cut all pieces slightly oversize, as chipping at the edges is unavoidable. Trim rough edges later.

Wax the top surface of the laminate with a liquid floor wax to avoid scratches during installation and to keep unwanted cement from sticking. After bonding, all surfaces must be rolled with a small hand



7. PROP BACKSPLASH STRIP temporarily against the wall with scraps of plastic to hold it like this. Slip metal cap strip over the top edge and scribe a pencil line along the wall. Then remove the plastic and nail the cap strip to the wall along the penciled guide line.

10. TO MAKE AN INVISIBLE SEAM, clamp the two meeting sheets to a board with a slight gap between them. Then run a router through the gap along a straightedge; it will cut two perfectly matching edges. To line up the router, make a gauge as shown in sketch at right.

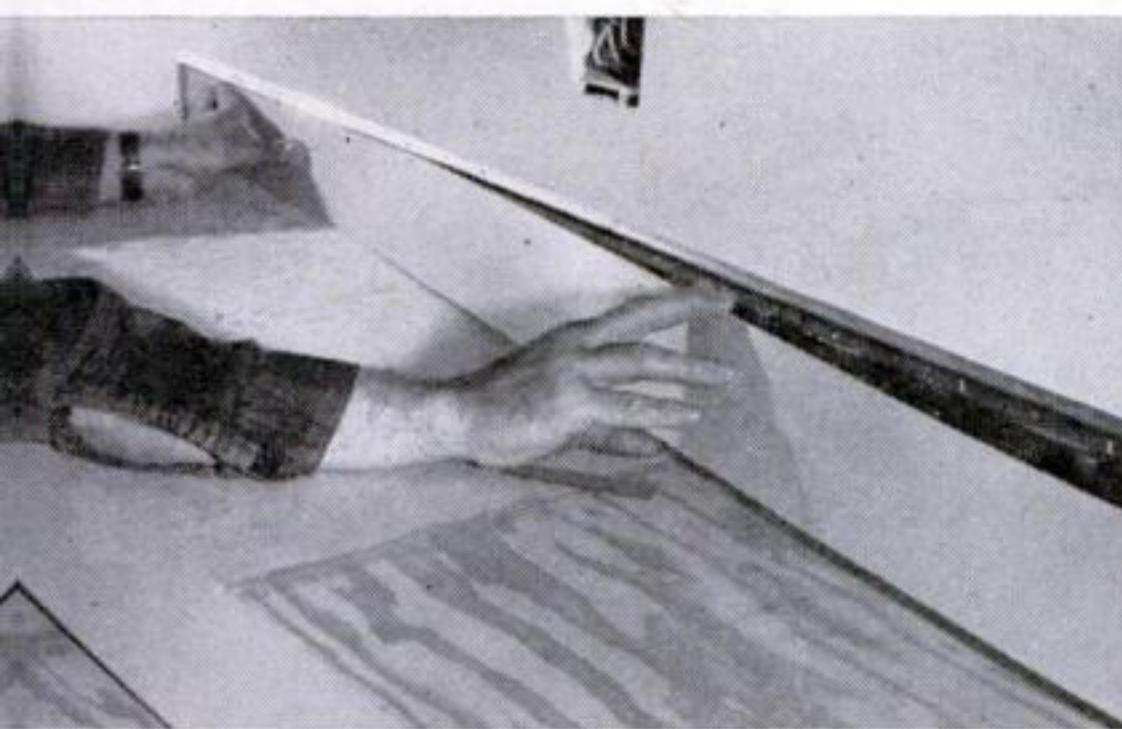




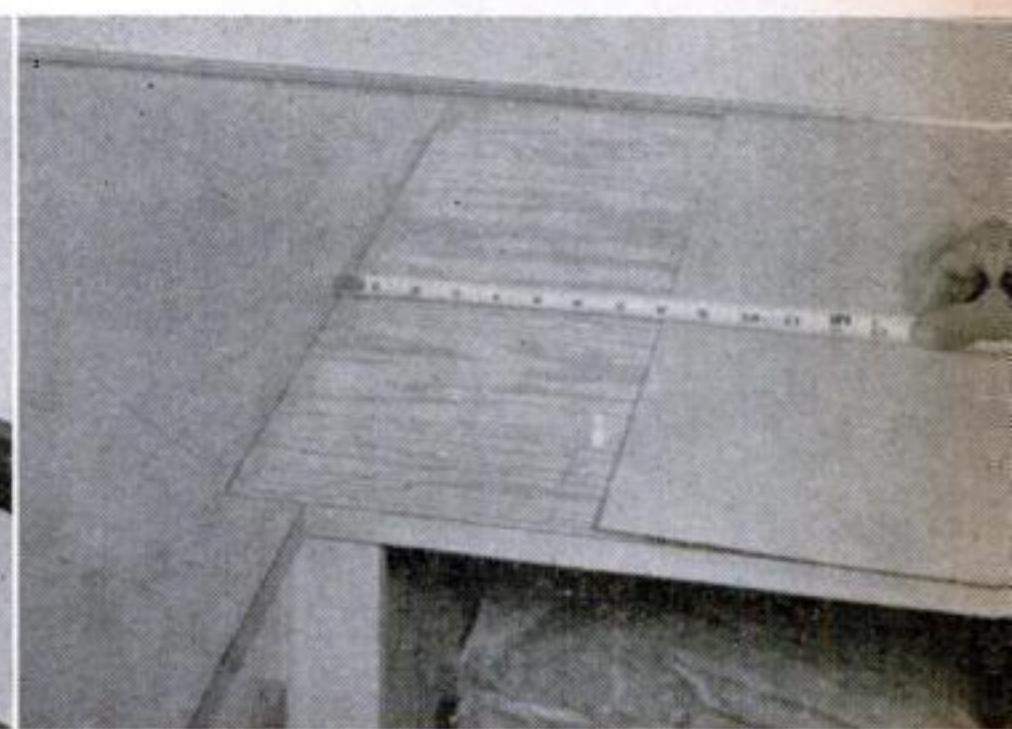
5. NEATEST TRIMMING JOB is with a router and special cutter, as above. Roller guide rides on top of counter, holding the bit at an exact depth so it trims the edge strip off flush.



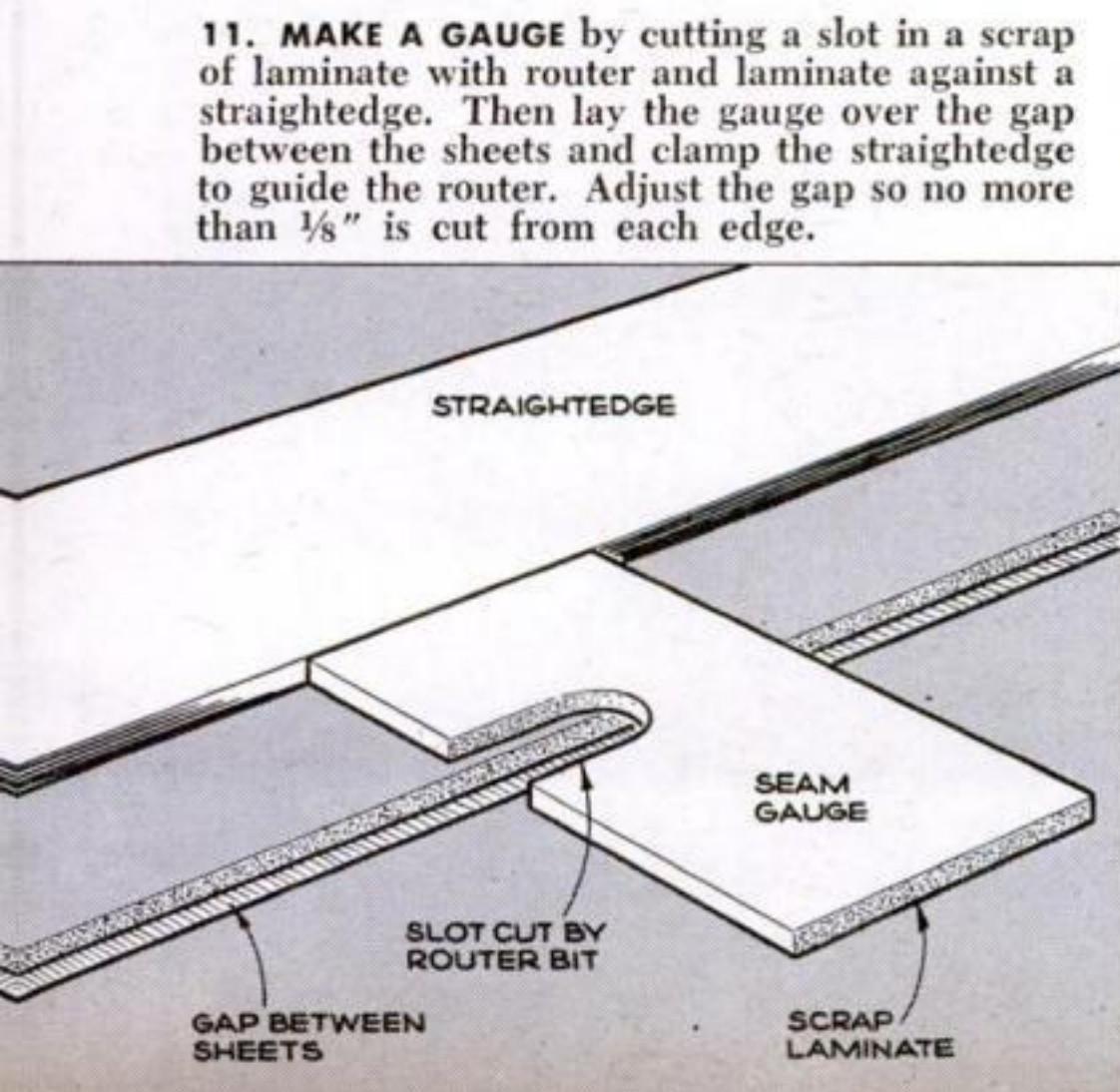
6. USE A FILE to remove the slight burr usually left by the router bit. Hold the file perfectly flat and cut only on the forward stroke to avoid chipping off the plastic at the edge.



8. SLIP BACKSPLASH STRIP into end of cap molding and gradually, with twisting pressure, work it into the slot along the cap. Contact cement won't bond well to painted walls, so use mastic for this job—a thin coat on the wall and a thick, combed coat on the laminate.



9. LAY OUT THE COUNTER TOP so no seams in the laminate are closer than 8" to joints in the plywood counter. This keeps gaps or unevenness in the joints from later opening up the seams. Metal cove strip is nailed to bottom of backsplash after the backsplash is in place.

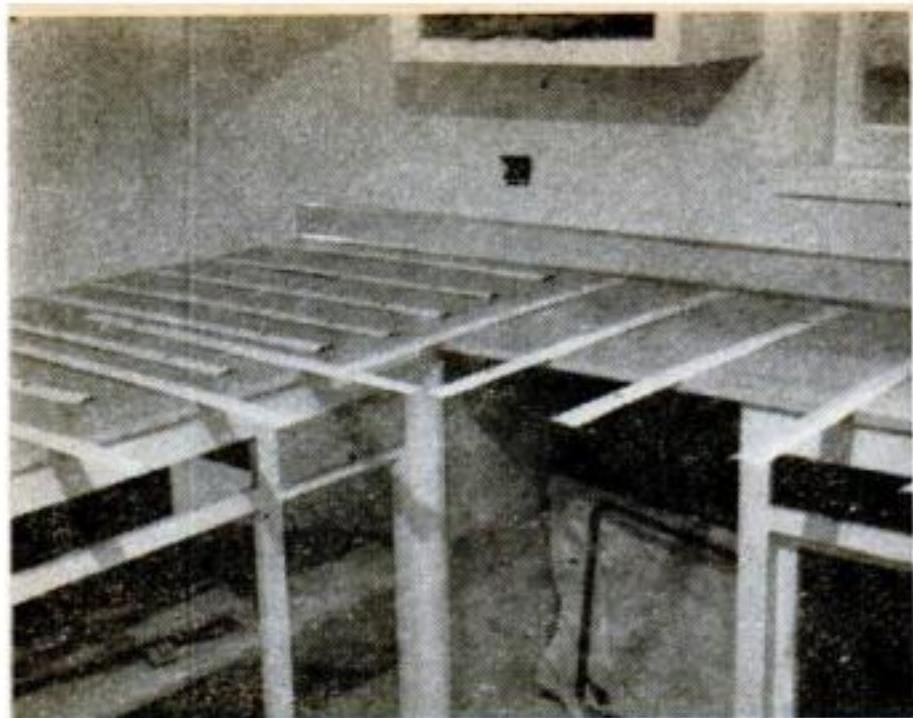


11. MAKE A GAUGE by cutting a slot in a scrap of laminate with router and laminate against a straightedge. Then lay the gauge over the gap between the sheets and clamp the straightedge to guide the router. Adjust the gap so no more than $\frac{1}{8}$ " is cut from each edge.

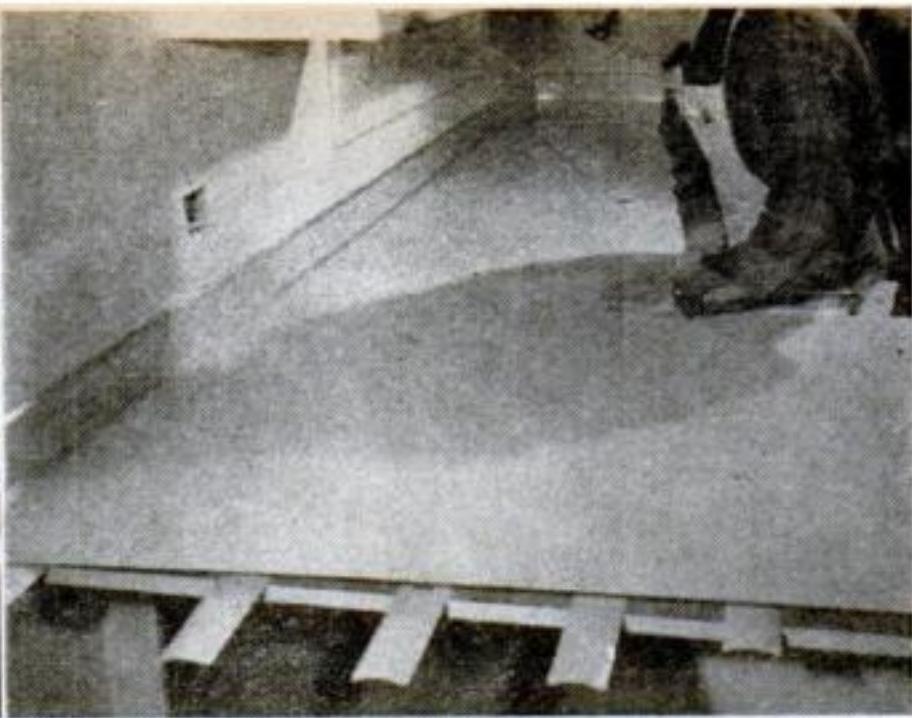
12. SPREAD CONTACT CEMENT with the special applicator made for the purpose. Keep cement $\frac{1}{2}$ " away from edges that fit into metal channels or it will be difficult to slip them in.

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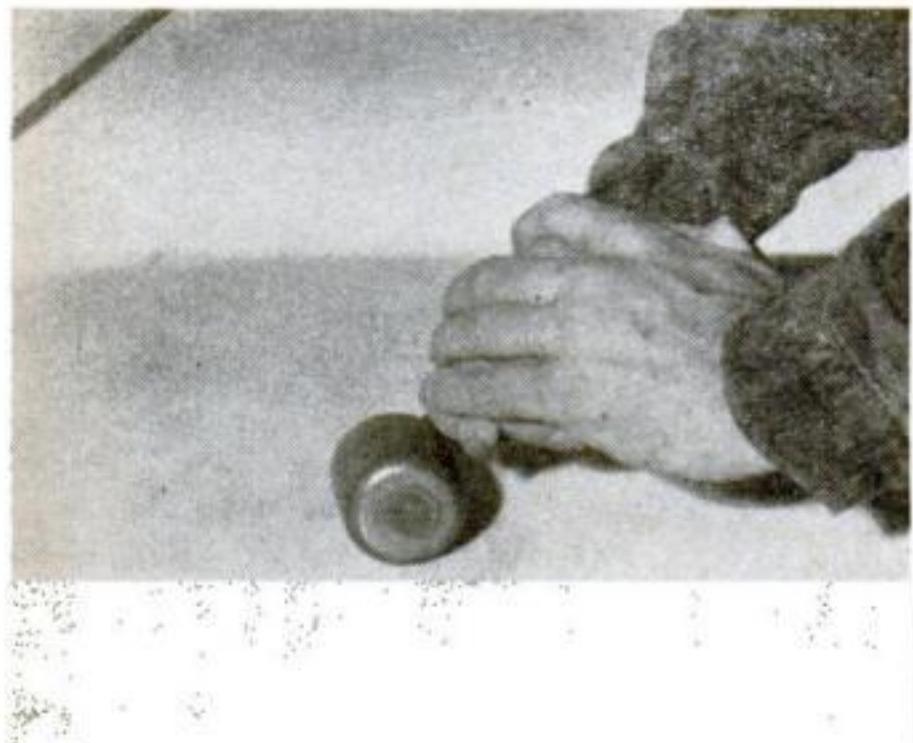


13. TO KEEP SHEETS FROM TOUCHING the counter while they're being positioned, the pros lay out old Venetian-blind slats. Thin wood slats, wires, or scrap strips of laminate can also be used, but waxed paper is no longer recommended as it often sticks. Slide the slats out one at a time when sheets are in place. Where two sheets join, leave slats under and to each side of

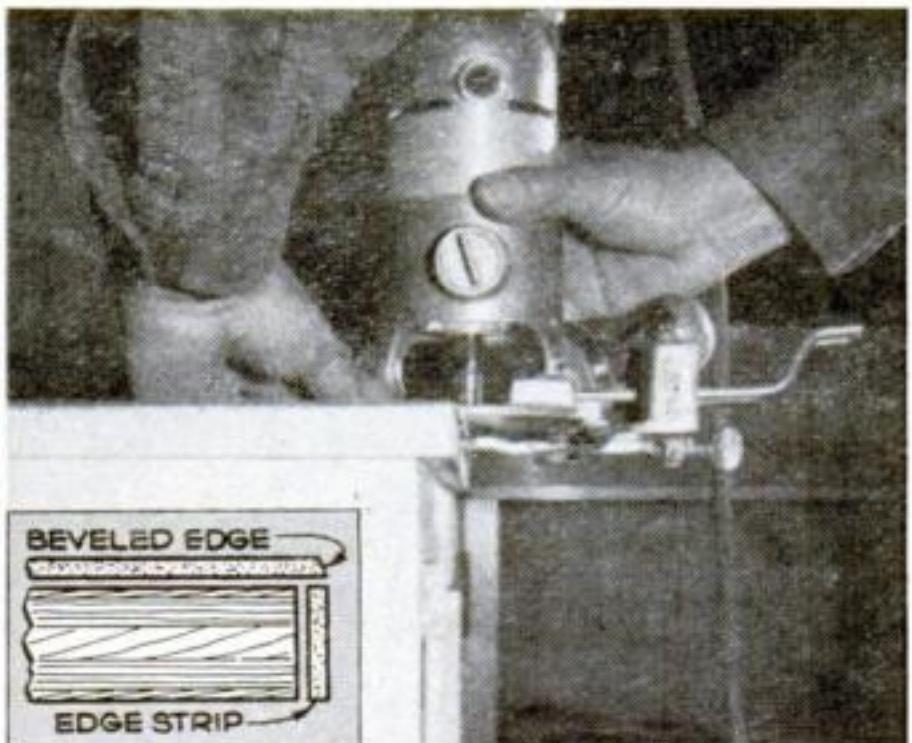


EDGES WEDGE TOGETHER
A technical sketch showing a cross-section of two laminate sheets. The top sheet is labeled "EDGES WEDGE TOGETHER" with an arrow pointing to its edge. The bottom sheet is labeled "PULL THESE SLATS LAST" with an arrow pointing to its edge. The distance between the edges of the two sheets is indicated by a double-headed arrow labeled "r".

the seam, as shown in sketch above. Pull all other slats, then remove those under the seam. This creates a wedging action that forces the edges of the sheets tightly together.



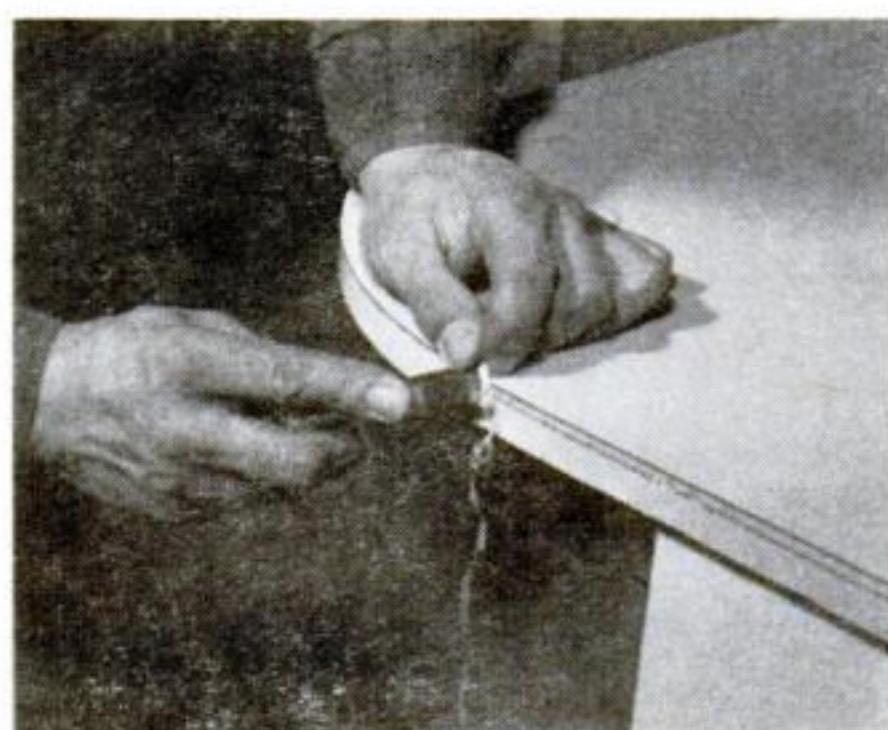
14. ROLL THE SURFACE with a small hand roller to insure firm contact. Start at center of counter and work toward ends or sides. Don't roll unsupported edges or the plastic may crack.

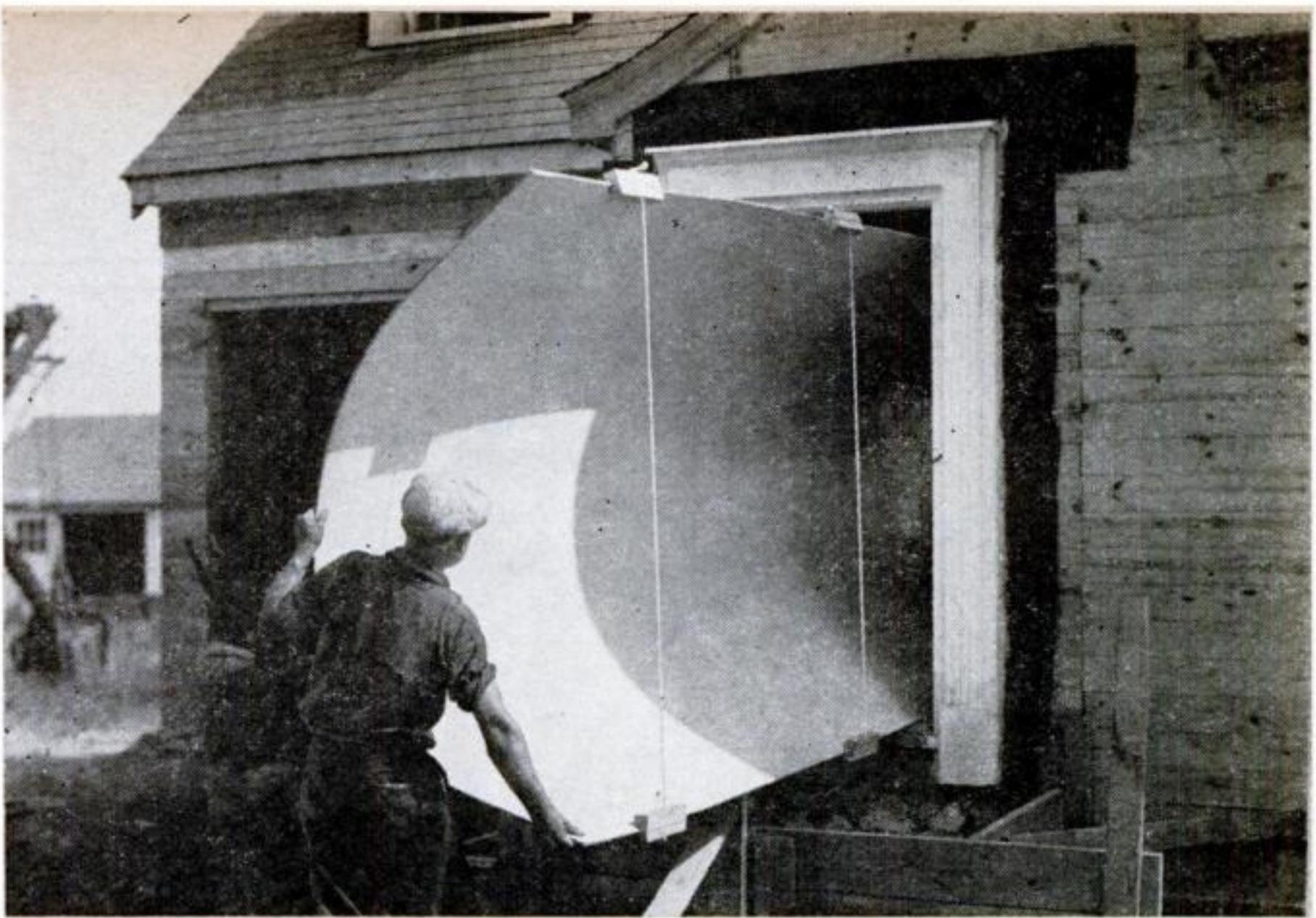


15. FRONT EDGE IS TRIMMED with a special router bit that puts a slight bevel on the laminate. Set the router guide carefully to be sure that bit doesn't cut into the edge-facing strip.

roller, which you can also rent. Regular plastic laminate can be safely curved to a 6" radius, but for sharper bends a special post-formed laminate must be used. If a seam between two sheets won't lie flat, the higher side can be hand-sanded slightly to bring it level. Sand an area several inches back from the edge to create a gradual taper that will allow the sheet to lie flat.

16. FINAL STEP is to remove the frayed edge left by the router. Do this with a sharp chisel. Leaving a slight burr is necessary to insure against cutting too close to the edge strip.





GIANT PANELS 20' long can cover an entire wall, eliminating cutting and fitting of joints. Tied into a U shape like this, they can be shoehorned in through any standard-size doorway.

The Surprising Facts About Softboard

REMEMBER old-time softboard? It had a rough, frizzy, unhandsome surface, and you could put your foot through it if you weren't careful. Its chief charms were that you could buy stacks of the stuff for practically nothing and work it easily. You threw it up to rough-finish an attic or basement, and maybe you still think of it that way.

But remarkable things have been happening to softboard. Modern research has toughened it, dressed it up, and turned it into one of the most versatile and fastest-selling building materials made. Today, it goes under such names as insulating building board, fiberboard, composition board, or—loosely—just wallboard. More than \$60,000,000 worth of new homes have been built with one

brand alone; sales of another are well into the billions of square feet.

There are good reasons for this. Line a room with this modern offspring of early softboard and you have built-in insulation as well as a finished surface. Manufacturers claim it will insulate up

to three times better than plaster and other wall materials. It also acts as a soundproofing surface—in fact, many of the familiar acoustic ceiling tiles are made of essentially the same material.

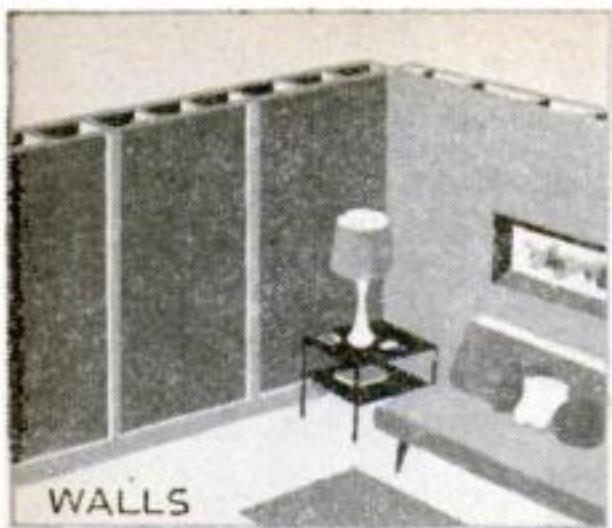
In its toughest form, you can push a hatpin through it yet bounce a hammer off it without leaving a mark. Drive in the right type of nail and it takes a 92-pound pull to get it out. Use it to sheath a house and it's said to be 300 percent stronger than regular sheathing boards—

materials file

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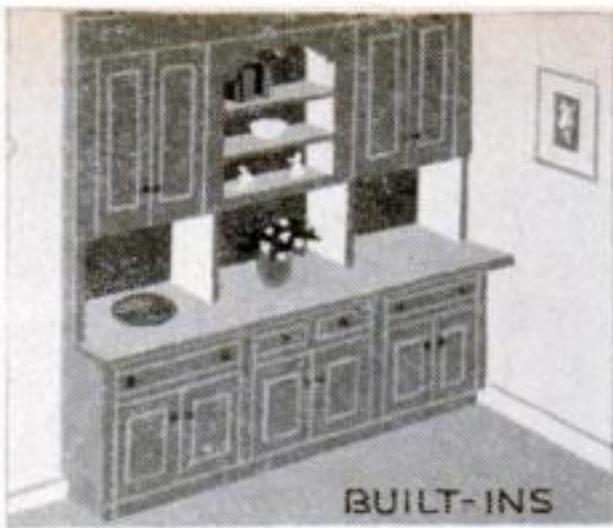
There's a softboard for almost every need around a home



WALLS



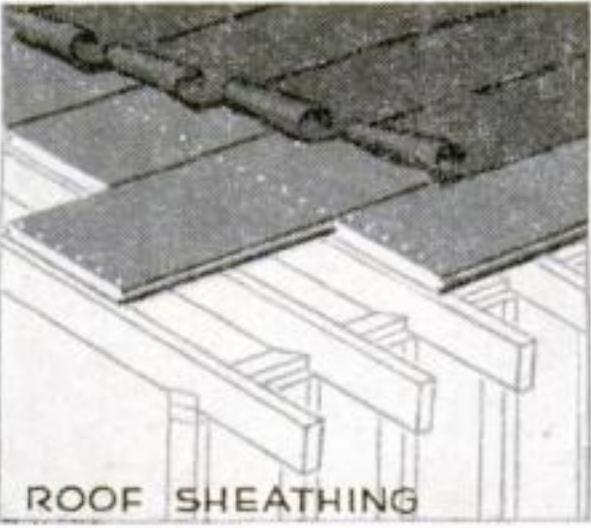
CEILINGS



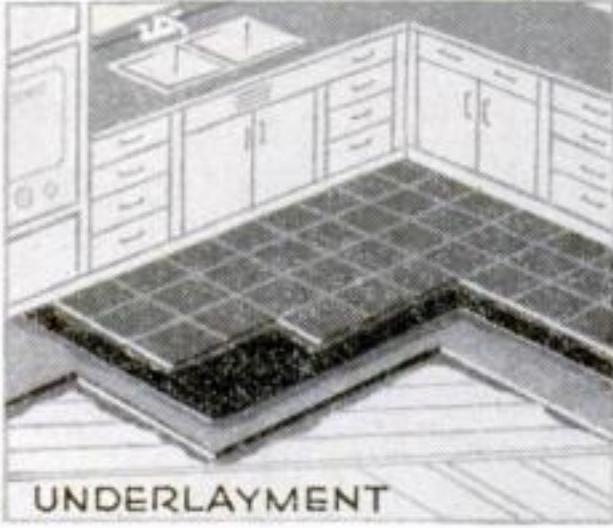
BUILT-INS



SIDING



ROOF SHEATHING



UNDERLAYMENT

so strong that houses built of it have survived hurricanes that demolished conventionally sheathed homes.

Despite its strength, softboard is unusually light. A 4'-by-8' sheet weighs only 24 pounds—a welcome feature when you're juggling panels overhead.

Softboard gets its light weight and high insulating abilities from its loose, porous structure of wood fibers that contains millions of tiny air spaces. This trapped air, although much less than the air space between wall studs, actually does a better insulating job. Reason: It can't move. In large air spaces, convection currents carry heat from the inside wall surface to

the outside, partially destroying the insulating value of the air.

Types of softboard. Besides plain panels, you can get all sorts of decorative effects: planks, ceiling tiles, random-width paneling, prefinished colored panels, striated or wood-grain textures. One special type serves as a sound-deadening underlayment for carpets. Another is made to cover a concrete slab to insulate it, block dampness, and provide a base for any floor covering you want.

For sheathing a roof, planks come up to 1 $\frac{1}{8}$ " thick. These combine roof structure, insulation, and a finished inside ceiling all in one. You simply leave the rafters exposed and the V-grooved inner surface provides a pleasing planked effect. The surface is vapor-sealed with bonded-on aluminum and comes pre-painted. This type of sheathing is so strong that it lets you space rafters up to 4' apart. You can walk on it, even jump on it, without harm. The top surface is waterproof and serves as a base for any type of roofing you want to put on. Other special boards are made for both sheathing and finished siding on exterior walls.

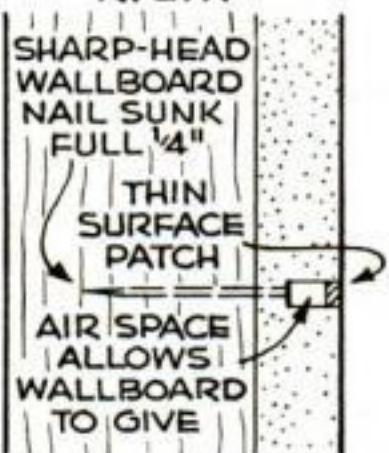
How you use it. If softboard is so good, why use anything else? It has one drawback that manufacturers have not yet been able to overcome: You can't

How you can conceal nailheads

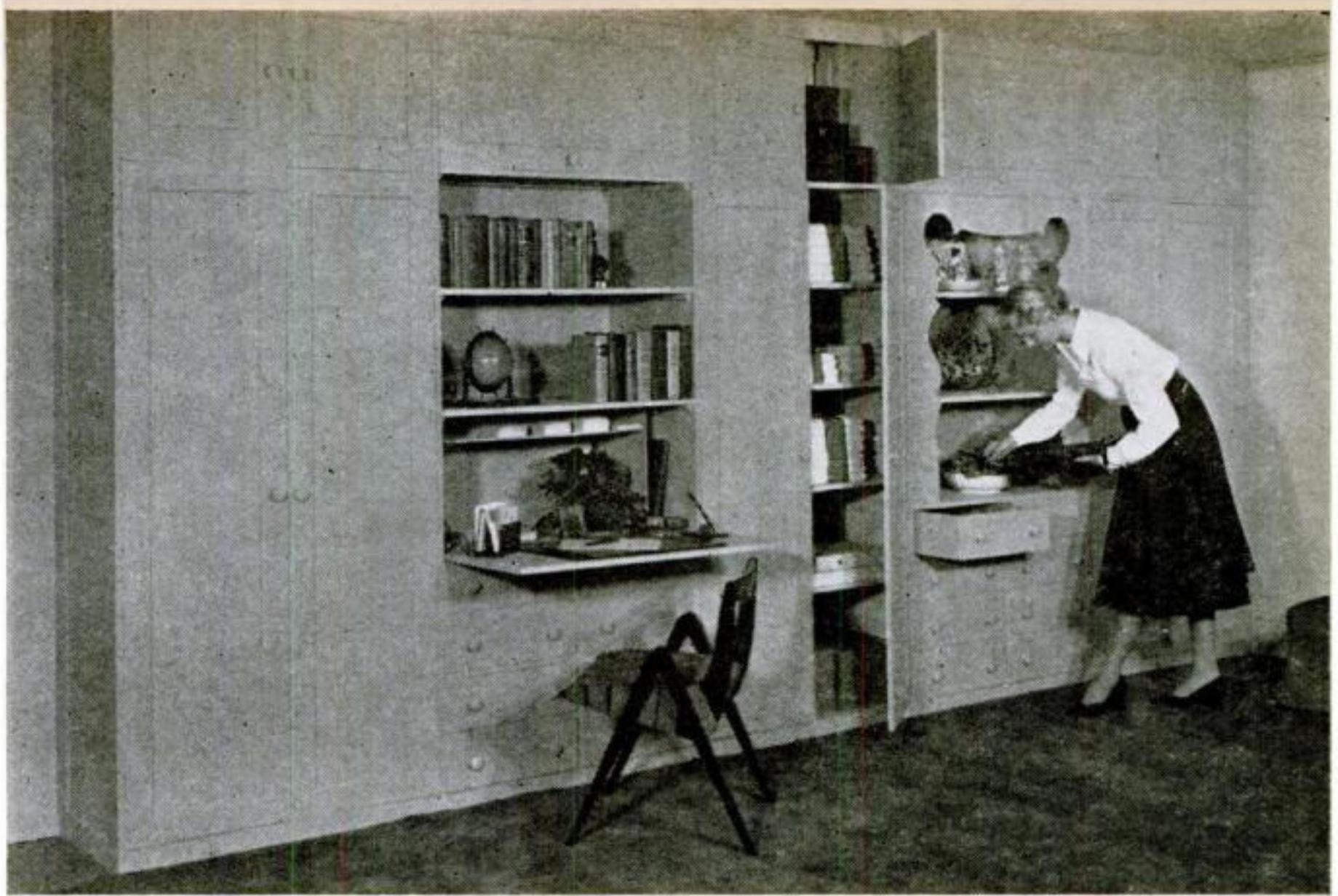
WRONG



RIGHT



ORDINARY NAILS "POP" because they make big, hard-to-patch holes. As wallboard shrinks, the heads push out the patches, as at left. Special wallboard nail at right makes a small, clean hole. A thin patch then creates an air space for the nail to push into without harm.



SWANK BUILT-INS are made economically by covering a light wood frame with panels of soft-

board. Doors are trimmed with molding strips to make them rigid and permit mounting hinges.

successfully tape and plaster seams because expansion and contraction of the board caused by changes in humidity will open up cracks.

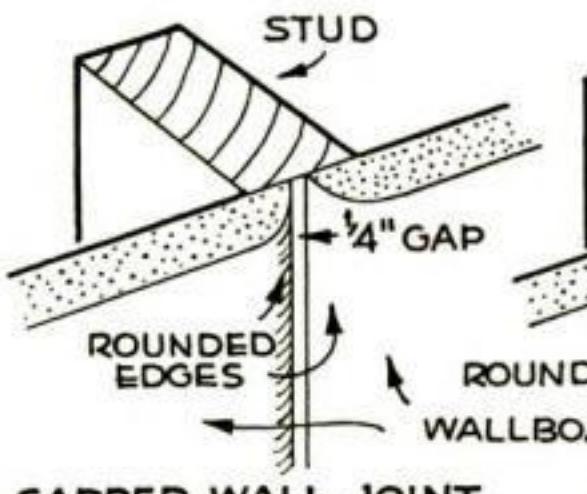
There are ways around this problem, however, that actually take less time and skill than conventional methods. One is the development of wall-size panels up to 8' wide by 20' long—big enough to cover an entire wall in an average room without a single seam. You just cut out the door and window openings and nail the panels

up. Their light weight makes it possible to handle such jumbo sizes easily.

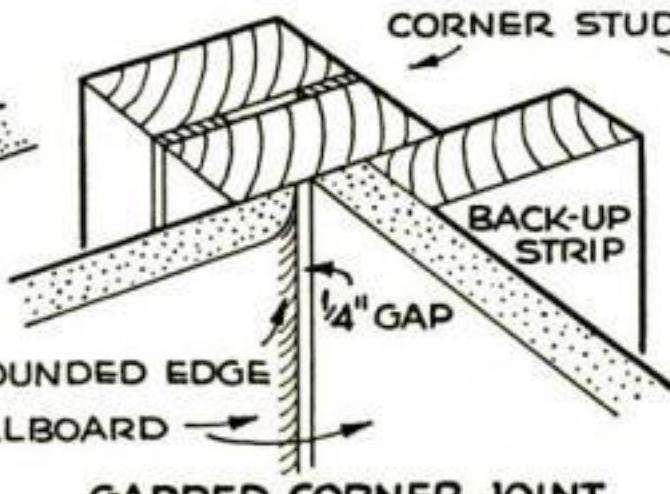
Another trick is to exaggerate the seams instead of attempting to hide them. The edges of adjoining panels can be beveled or rounded to turn them into an attractive decoration. This can be done with a saw, sander, router, or just a slanted knife blade.

If you prefer to work with small pieces, pick plank or paneling strips that you can mount with hidden fasteners or

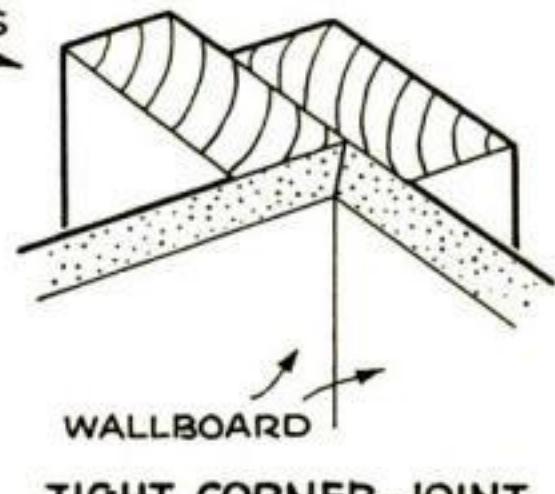
Three ways to get neat seams in softboard



GAPPED WALL JOINT



GAPPED CORNER JOINT



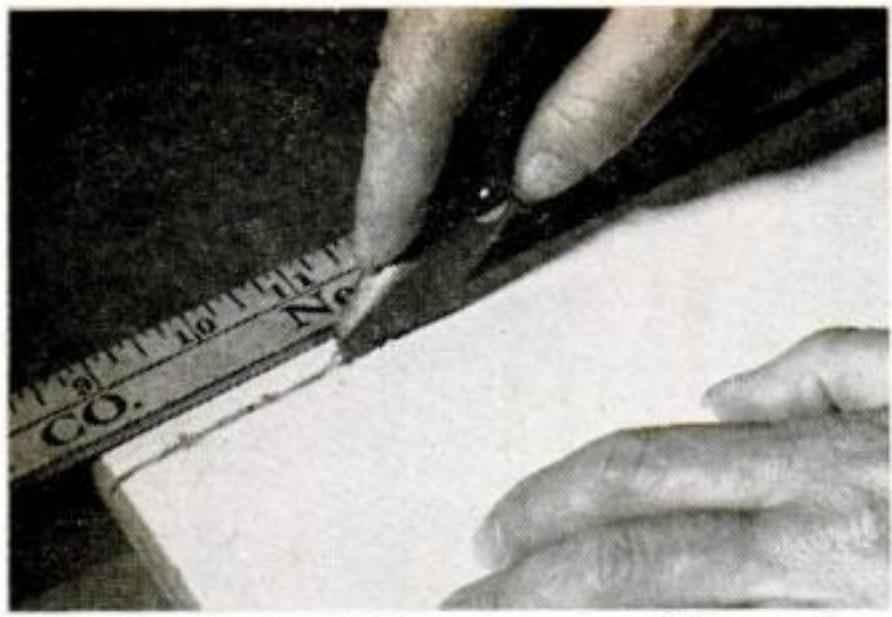
TIGHT CORNER JOINT

BY GAPPING PANELS SLIGHTLY, you eliminate batten strips, and joints can expand and contract without affecting their appearance.

Edges can be rounded, as at left and center above, for a pleasing effect. For a tight corner, at right, panels can be mitered.

CONTINUED

167



IT CUTS EASILY—with no messy sawdust—when you use a sharp blade or special wallboard trimming knife. Thin boards cut through in a single stroke; thick ones require two passes.

staple through concealed flanges. Panels are available with shiplap or beveled tongue-and-groove edges that match decorative groovings in the face so you can't tell where the real joints are. These conceal nails and also allow for expansion and contraction.

How to choose the best type. Softboard comes in a number of different thicknesses and grades of density or hardness. Your choice here is between maximum strength, which the dense, hard boards give, and maximum insulation and sound absorption, which the lighter boards give. The dense boards are also a little heavier to handle and usually a little higher in price.

If you're lining an attic to make an adult guest room, a lightweight board will save you money and provide the greatest insulation. If you're making a playroom for the kids, the harder type is your best bet—a misguided tricycle can break through a light board but not a dense one.

Another factor in your choice is moisture. The light insulating boards are seldom factory-treated to resist moisture absorption. Used in a steamy bathroom or kitchen, they can pick up enough moisture to lower their insulating value, just as a wet blanket no longer keeps you warm.

For such damp-area applications, be sure to choose a board that's designed to withstand moisture. You'll find two types, one with a surface that has been sealed to prevent moisture from passing through, and another in which the fibers themselves have been chemically treated to resist moisture. It's important to know

what you're getting because some manufacturers provide both protected and unprotected versions of the same identical-looking board.

If you plan to use softboard to resurface an old, cracked ceiling, pick a lightweight type made for the purpose. This is a fairly dense, tough board but light because it's thin—usually $\frac{1}{4}$ ". It is much less likely to crack or break than a softer board twice as thick—important if you're doing a ceiling job yourself. Such panels weigh as little as 16 pounds for a full 4'-by-8' sheet.

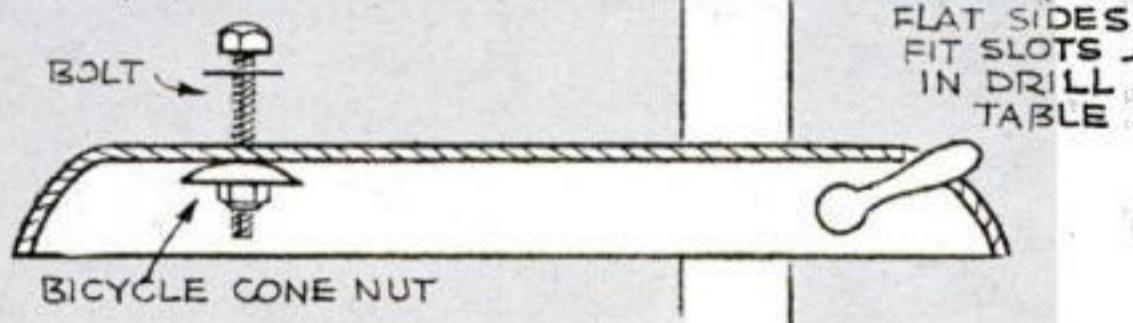
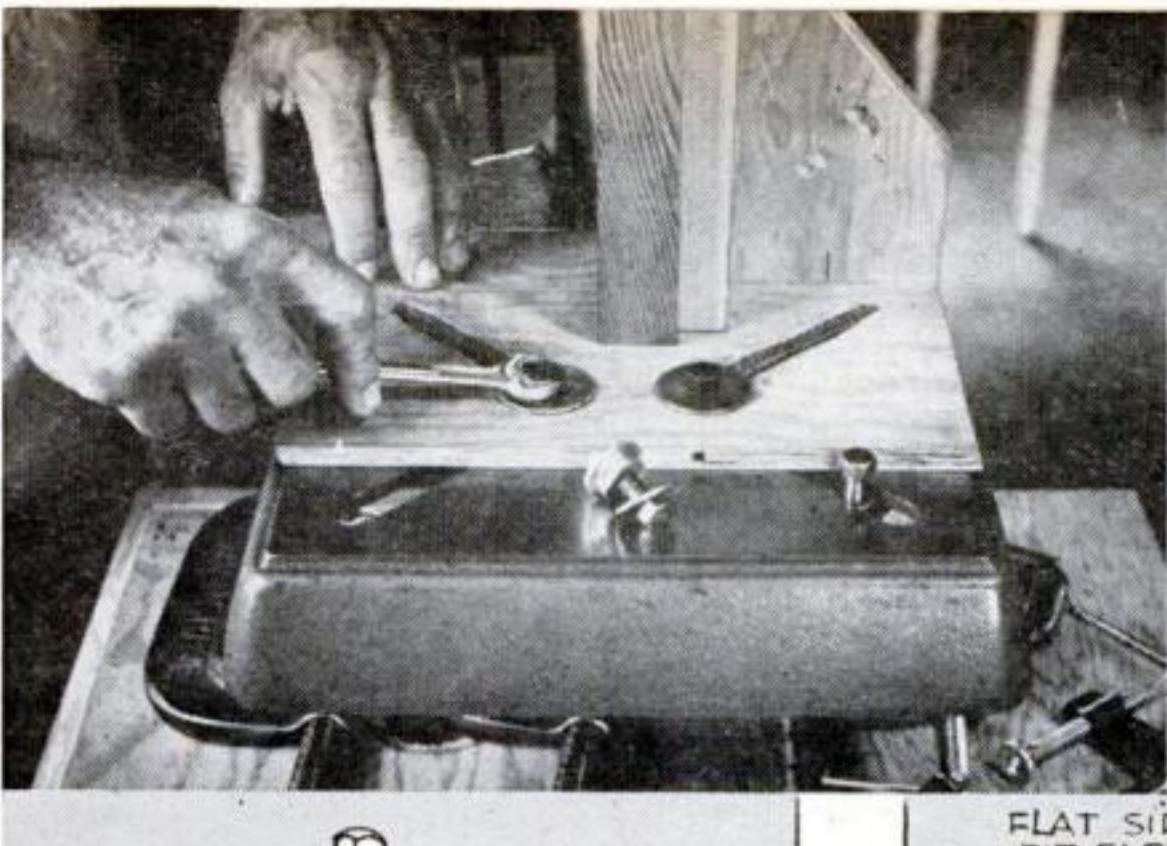
For walls, panels should be $\frac{3}{8}$ " or more thick. Newly introduced smooth-faced panels provide a slick wall surface that's ideal for formal living and dining rooms. However, the more common fabric-like and pebble-grain surfaces have a special virtue: Their texture helps hide nails and blemishes and reduces glare reflections.

For exterior sheathing, siding, floor underlayment, and other special jobs, be sure to get a board that's made for the purpose. Weights, and often chemical treatments, vary widely according to the use. Sheathing, for instance, is usually made extra dense to provide more nail-holding power.

Although special plank and tile forms cost up to 25 cents a square foot, standard factory-painted light-body panels sell for as little as 8 cents a square foot and denser types for about $9\frac{1}{2}$ cents.

How to get a good job. To keep panels from expanding and bulging after they're installed, the lighter types are left unstacked for 24 hours in the room where they are to be used so they will pick up moisture and expand ahead of time. Denser types are hosed down and stacked flat overnight. After installation, the slight shrinkage during drying assures a flat surface.

To prevent nail patches from "popping"—being pushed out as the wallboard shrinks—the nailheads are deeply countersunk. The heads are then covered over with a thin patch that leaves a small air gap between the nail and the patch. In this way, the nailhead never touches the patch and can't push it out. The air gap also keeps any moisture that condenses on the nailheads from coming through and spotting the wall. Special nails with sharp-edged heads are used to make small, clean-cut holes that are easy to fill.



Bike Cones as Hold-Down Nuts

CONE nuts that can be purchased in various sizes from a bicycle shop are ideal for clamping jigs and workpieces to the drill-press table. I found a size with a 5/16"-24 thread that works perfectly.

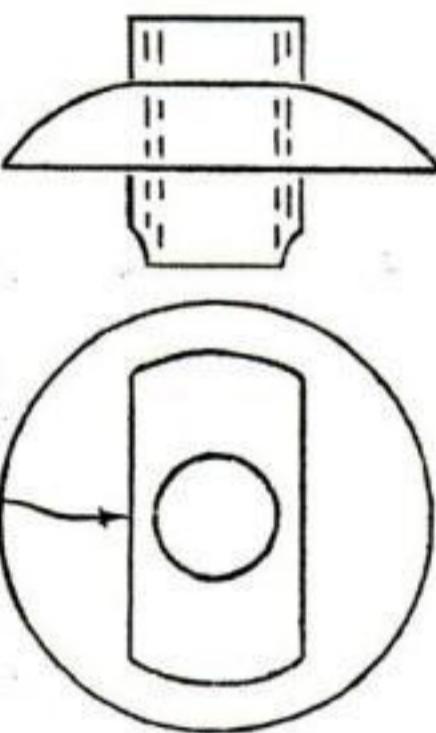


Wrench Serves as Handle

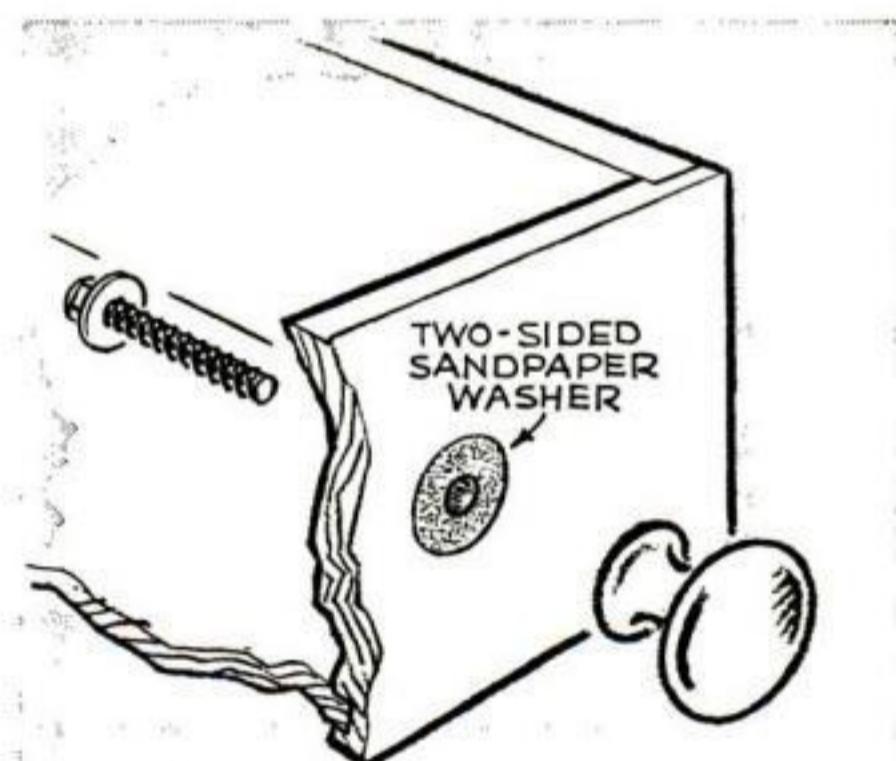
AN OPEN-END WRENCH—any size—slipped under the wire handle of a pail, as in photo above, makes easier work of carrying heavy materials. The weight is distributed along the broad side of the wrench, providing a grip that won't bite into your flesh as the wire often does.—*Steven R. Scadding, Toronto, Ontario.*

Short Cuts and Tips

FROM PS READERS



The two flat sides of the nut fit the slots in my drill-press table snugly so the nuts can't turn. Clamping bolts with nuts attached can be slid to any position in the slot and the nuts don't have to be held with a wrench for tightening.—*F. H. Louden, Sarasota, Fla.*



Sandpaper Washers Lock Knobs

INVISIBLE lock washers for drawer or cabinet knobs can be made by gluing two sheets of sandpaper back-to-back. Cut washers out of the double sheet to fit behind the knobs. When the screws are tightened, you'll find that the knobs will be almost impossible to turn.—*Daniel Bousha, Jackson, Mich.*

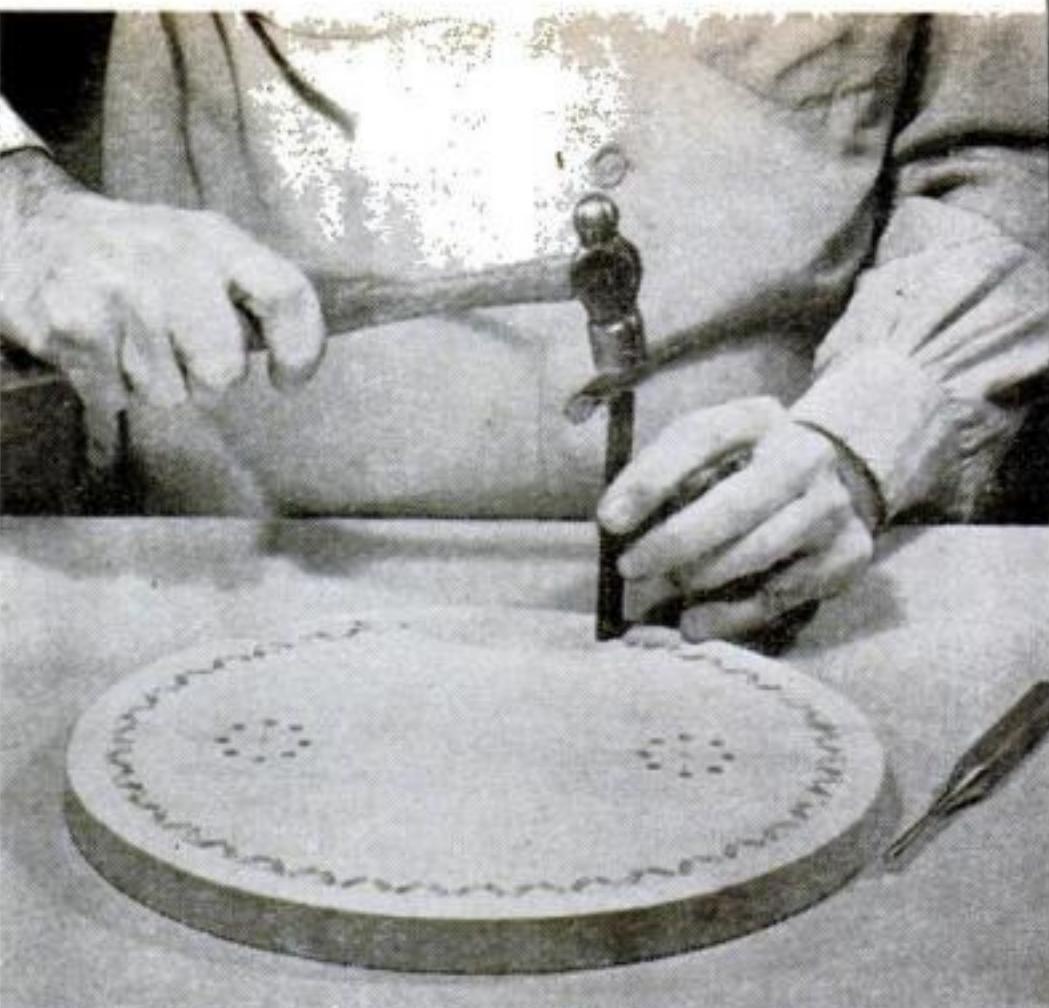
Inside-Out Carving

This ingenious trick produces raised designs in wood that will mystify your friends

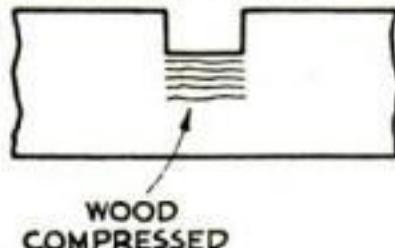


BEAUTIFULLY embossed designs in wood pop right out before your eyes in this ingenious method of inside-out carving. To create a pattern, you first punch grooves and dimples into the wood, then literally turn them inside out so they stand above the surface of the wood. The result is a raised design that has the look of a delicate hand carving without the tedious work. The striking three-dimensional effect makes attractive decorations for plaques, door panels, trays, lamp bases, and boxes.

The trick is based on wood's ability to be compressed and then return to its



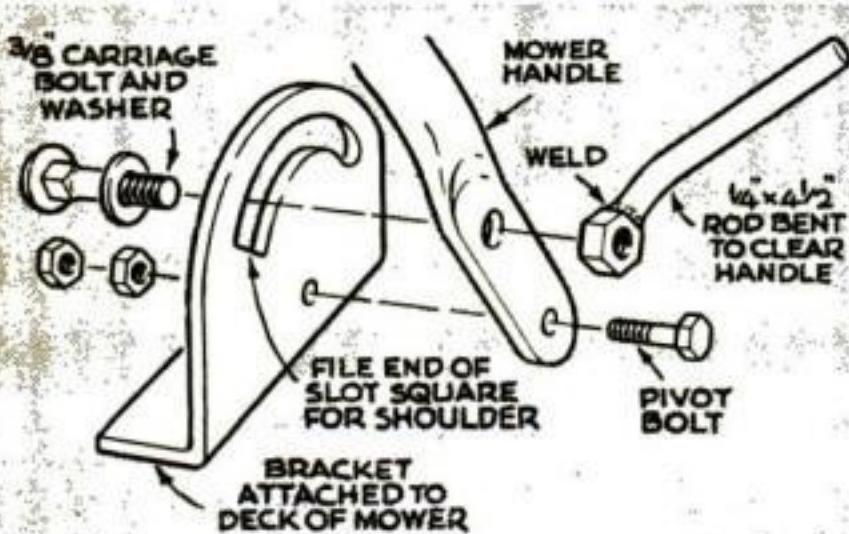
PUNCHING



DESIGN IS PUNCHED into wood, compressing fibers below surface. Two punches—a round one for dots and a rectangular one for ridges—produce a variety of handsome patterns.

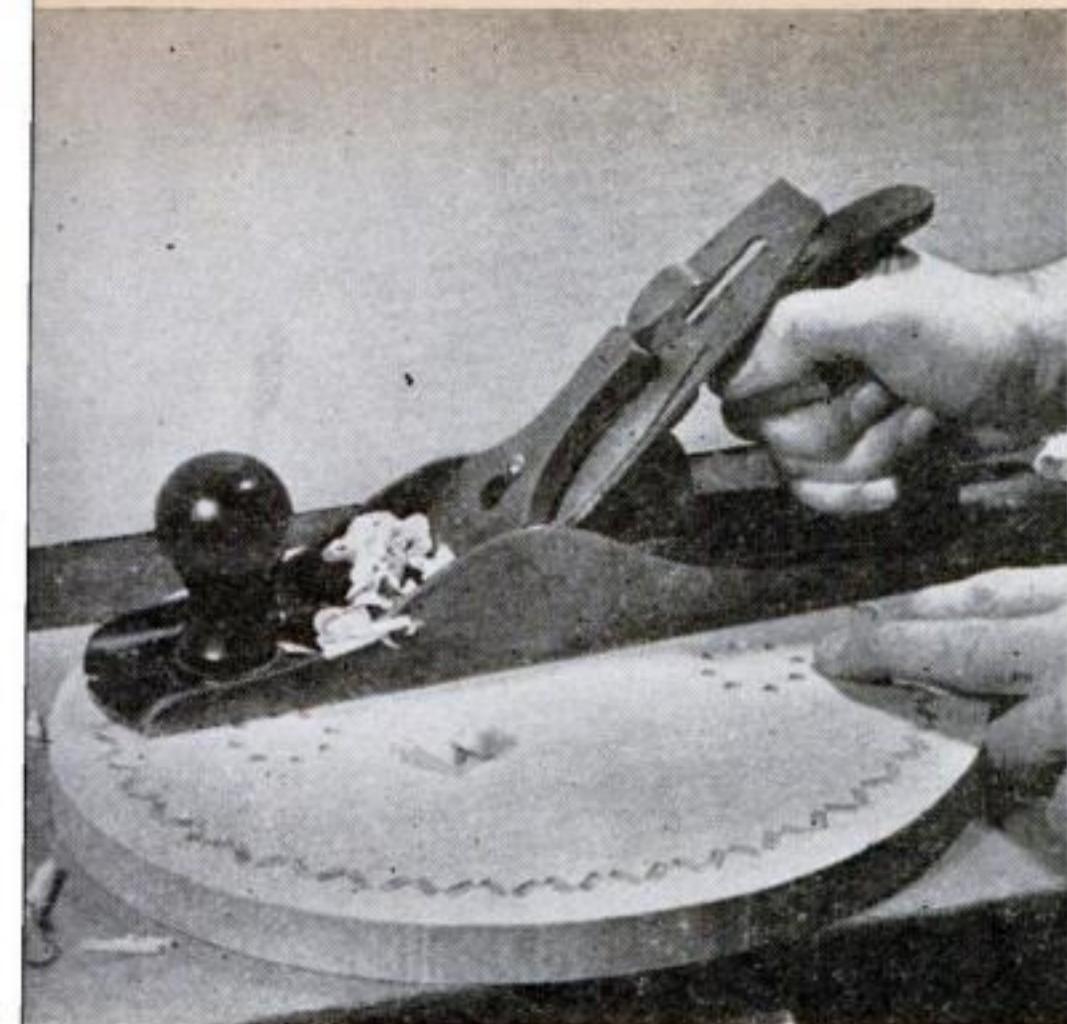
original shape after it has expanded. Using punches of various shapes, you hammer the desired design into the wood to a uniform depth of $\frac{1}{16}$ " to $\frac{1}{8}$ ", depending on the wood's hardness. Then you plane off the surface of the wood down to the level of the punched-in design. When the planed surface is steamed, the compressed wood fibers expand to their original height, turning the punched design into a raised image.

The method will work on any kind of wood except plywood, but the easiest to use is a softwood, such as clear pine. Designs can be sketched on the wood or

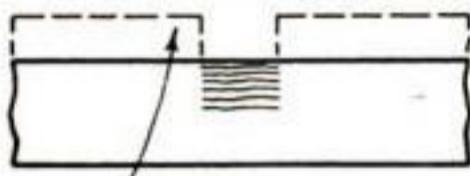


Mower Handle Adjusts Easily

MY ROTARY mower has a handle that pivots up for storage. The 3/16" positioning bolts in the handle brackets had to be loosened with wrenches and sometimes slipped in use. I replaced them, using carriage bolts with shoulders that just fit in the bracket slots. A rod, welded to each nut, provides a lever that makes tightening and loosening easy.—A. D. Allen, Plainfield, Ind.



PLANING

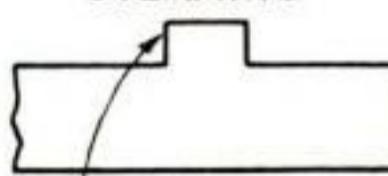


TOP SURFACE
REMOVED

WOOD IS PLANED OFF level with the punch marks, leaving a flat surface. Brace the wood against a stop block. Be careful not to cut below the level of the punch marks.



STEAMING



EXPANDED
WOOD RISES

STEAMING THE WOOD swells the compressed fibers so they rise above the surface. This produces an embossed design exactly duplicating the pattern of the original punch marks.

traced on with carbon paper from existing drawings.

For round figures representing flower petals, fruits, or rivet heads, you can use ordinary pin punches. Special punches for triangular, square, oval, and other shapes can be made from old files or steel bar stock. For long thin lines, curves, scallops, and other irregular designs, bend strips of metal into the desired shape and drive the edges into the wood. For rigidity, the metal should be at least $1/16$ " thick.

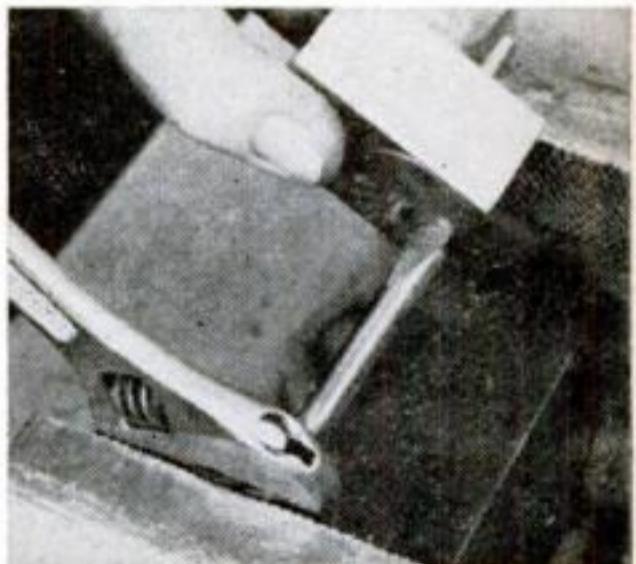
To bring out the design, simply hold it in the steam from a teakettle spout.

Three to four minutes should complete the expansion of the wood. If the raised figures aren't fully sharp, you can touch them up with regular carving chisels, which increase the effect of hand carving. You may also want to use a gouge to produce a carved texture over the entire panel. Light sanding and a stain or other natural finish complete the job.

The same method can be used to decorate lathe turnings. Just punch the design into the rough work, then turn down the surface and steam out the embossed pattern to produce a really eye-catching effect.—Walter E. Burton.

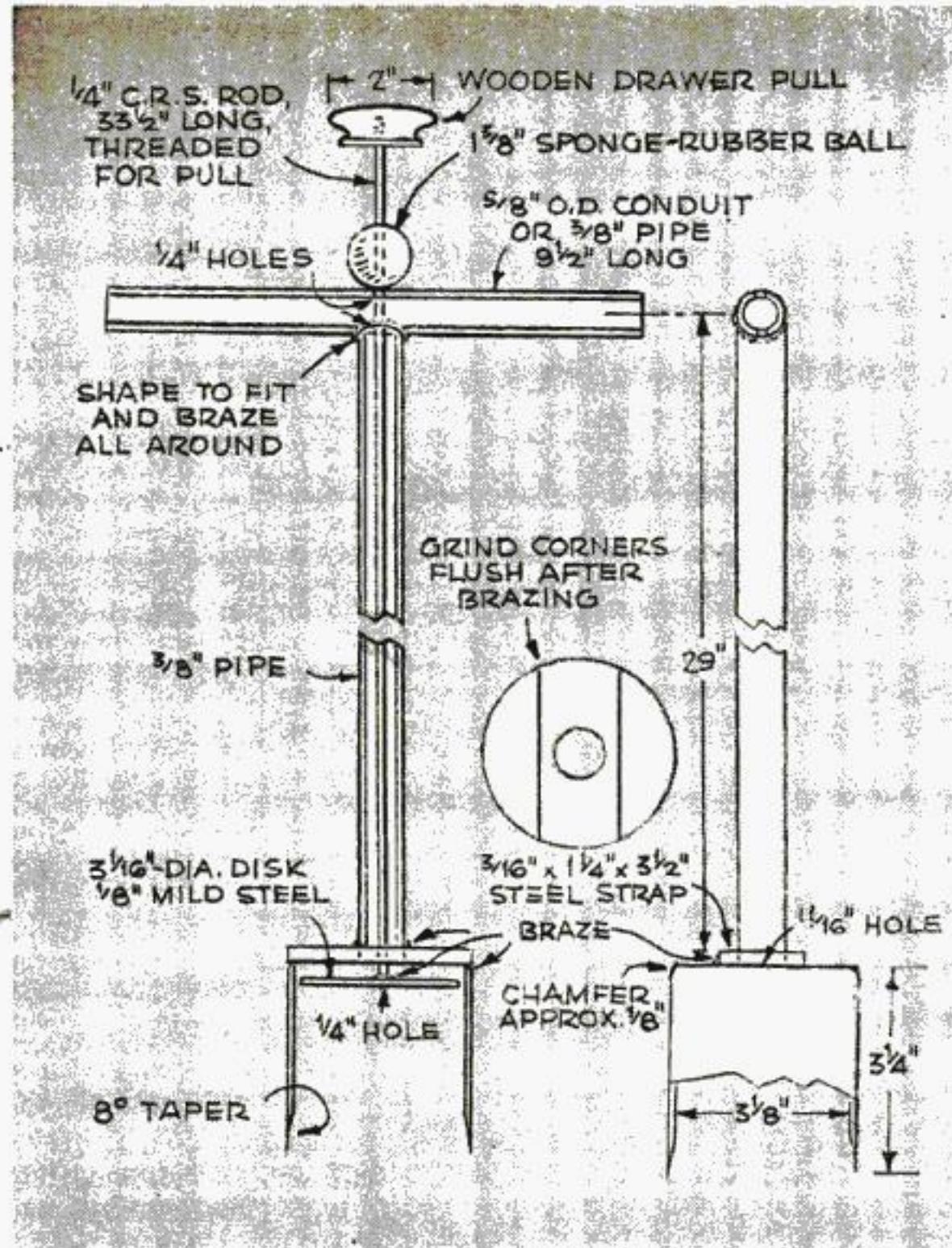
Stub Screwdriver Loosens Frozen Screws

THE handiest tool I've found for loosening rusted or frozen screws is a stub screwdriver I made by cutting off the blade of a square-shank screwdriver. The tool and work can be held between vise jaws to prevent the blade from coming out of the screw slot when torque is applied to the square screwdriver shank with a wrench. The vise jaws should not be fully tight as the screwdriver will need a little play to make part of a turn as the screw starts to back out.—H. J. Gerber, Stillwater, Okla.



Short Cuts and Tips

FROM PS READERS



Stand-Up Plug Cutter for Yard or Garden

I'VE made a gadget that cuts clearance holes around underground lawn sprinklers, serves as a bulb planter and grass transplanter—and even digs small post holes. To keep neighbors from borrowing mine, I've had to make 20 of these back-savers for local distribution.

I made the T-handled trimmer first. The cutter cup is 3" pipe. You just center it over a sprinkler head and press down on the handle with a twist to provide both shearing and cutting action. Later, when my wife had a batch of bulbs to plant, I added the rod and plunger (far left). The only problem was to provide a means of locking the plunger out of the way at the top of the cutter cup, so it wouldn't interfere with the tool's original use. Inserting the shaft through a rubber ball solved this problem.

You start with the plunger in this raised position, also, when digging holes for bulbs. Shove and turn the cutter full depth, and draw it out. The inside taper compresses the dirt so it won't slip out of the cup while you place the bulb in the hole. Then press on the top knob to eject the dirt, filling the hole above the bulb. To transplant, remove a plug of earth and replace it with a plug of new grass you've rooted for this purpose.—*Fred P. Faltersack, San Jose, Calif.*

**Here's how
to save
that costly
poolside
accessory**



Restoring an Old Diving Board

WHEN a laminated wood diving board begins to split at the seams, there's just one thing to do: cut it apart and glue it back together. This is an expensive job to have done, but not hard to do yourself.

If the cocoa mat is not worn, remove it and set it aside. Otherwise order a new mat from your swimming-pool dealer. Look for and remove tie bolts running through the board from edge to edge.

Since the board is going to be sliced along the old glue joints, a carbide-tipped blade is best used in the table saw. Feed the board into the saw slowly and have someone at the far end to support it. Number the strips so they can be reassembled in the same order. Light

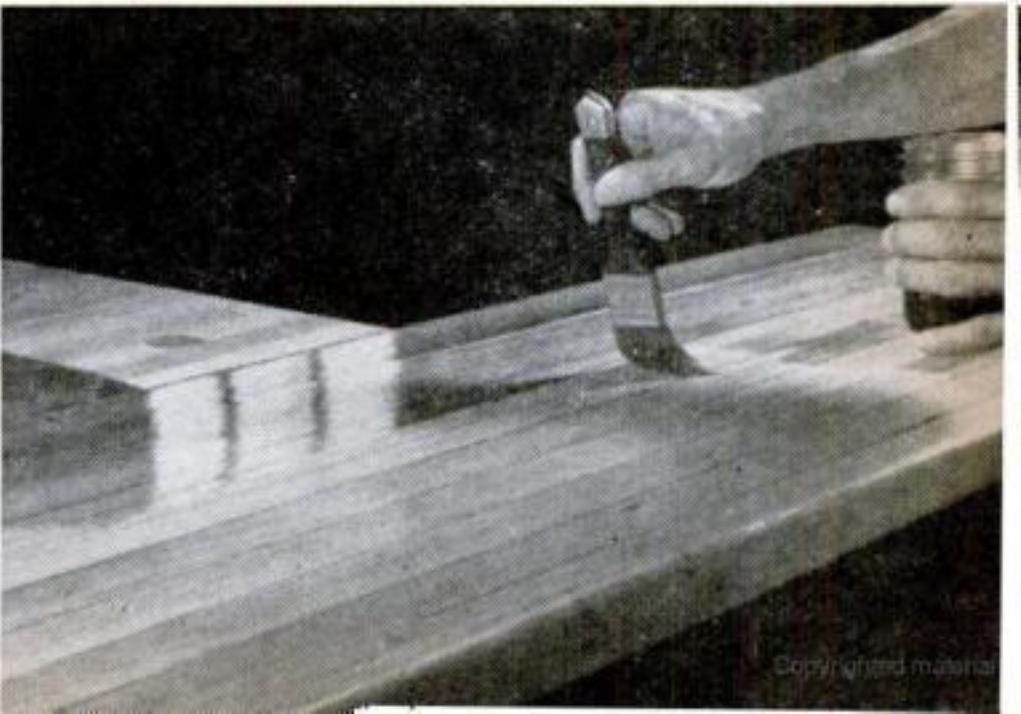
sanding will prepare edges for gluing.

Resorcinol glues such as Elmer's, Wilhold, or Weldwood waterproof types are best. Follow instructions carefully and do the job in an area not cooler than 70 degrees. Glue several strips together, clamp them tightly and allow them to dry overnight. Then glue and clamp more strips to those already assembled until the board is complete.

Install the tie bolts, and sand the surface of the board smooth. A belt sander, of course, will do the job quicker than hand sanding. Seal the entire board with several coats of spar varnish. Soak the cocoa mat, stretch it over the board, and tack it in place wet. It will dry tight and remain that way.—R. J. De Cristoforo.

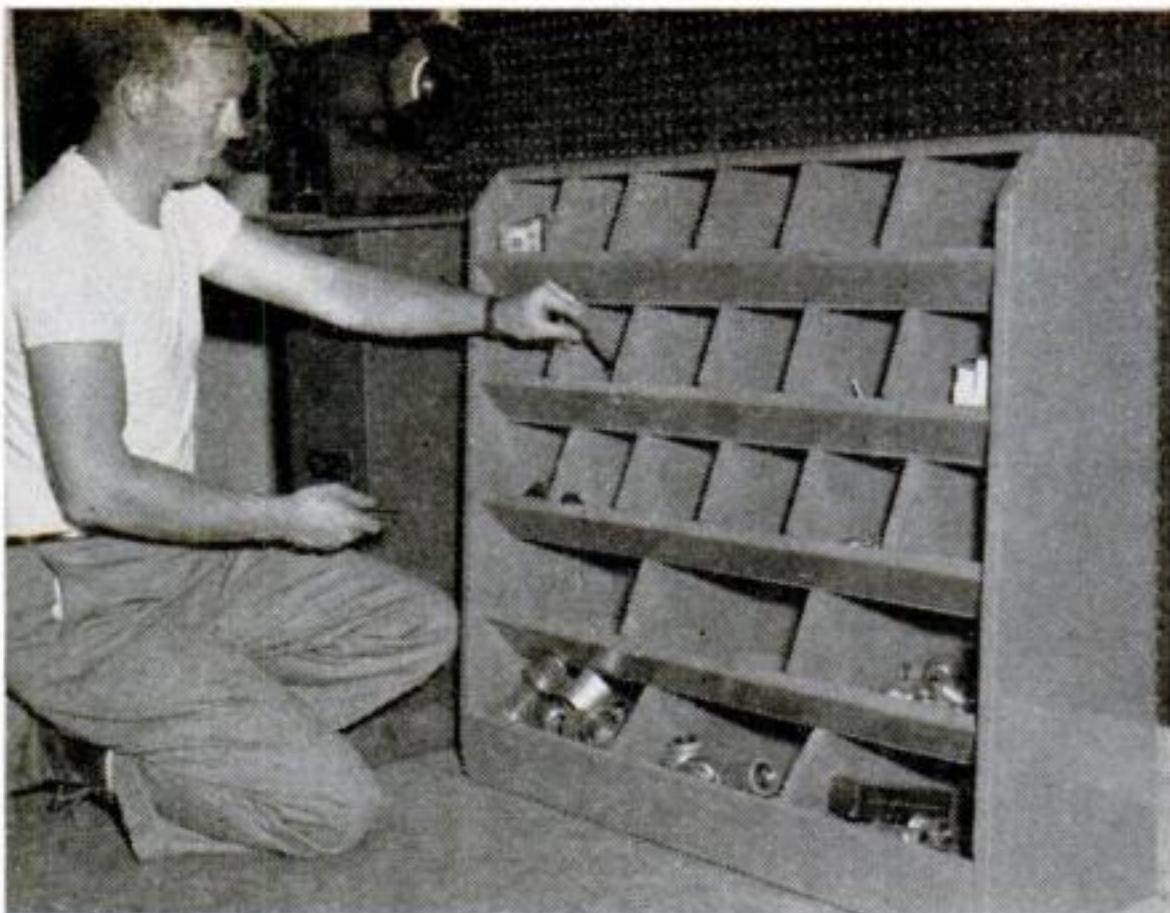
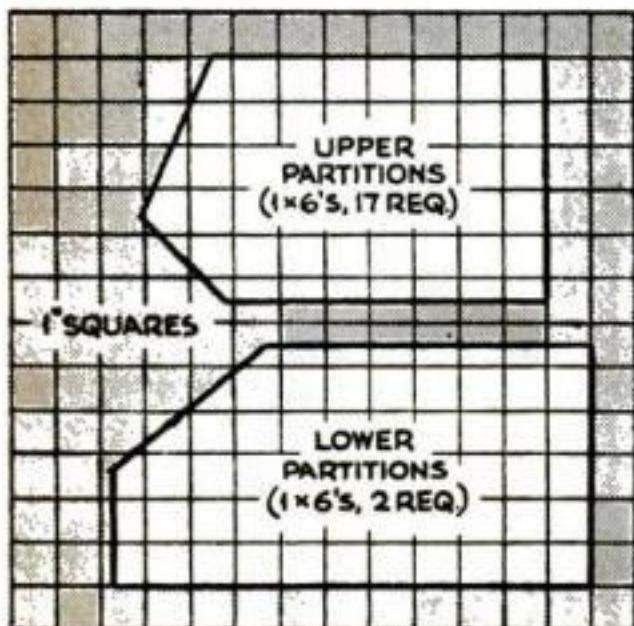
INSTALL NEW TIE BOLTS if the old ones appear rusted. Galvanized threaded rod, available in hardware stores, can be used. Set the nuts and washers into the edges of the board.

APPLY SEVERAL COATS of spar or marine varnish over the entire board. Allow plenty of drying time between coats, and sand each coat to provide a tooth for the one following.



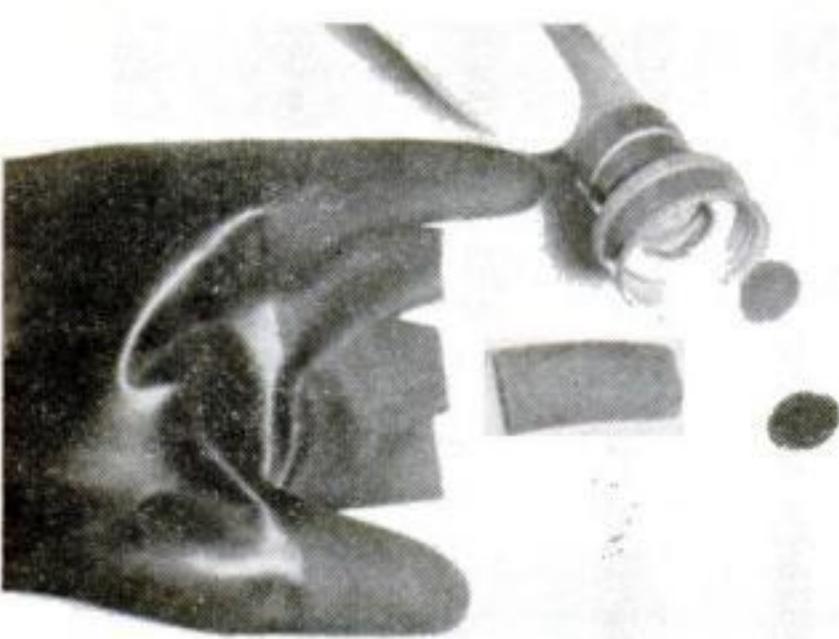
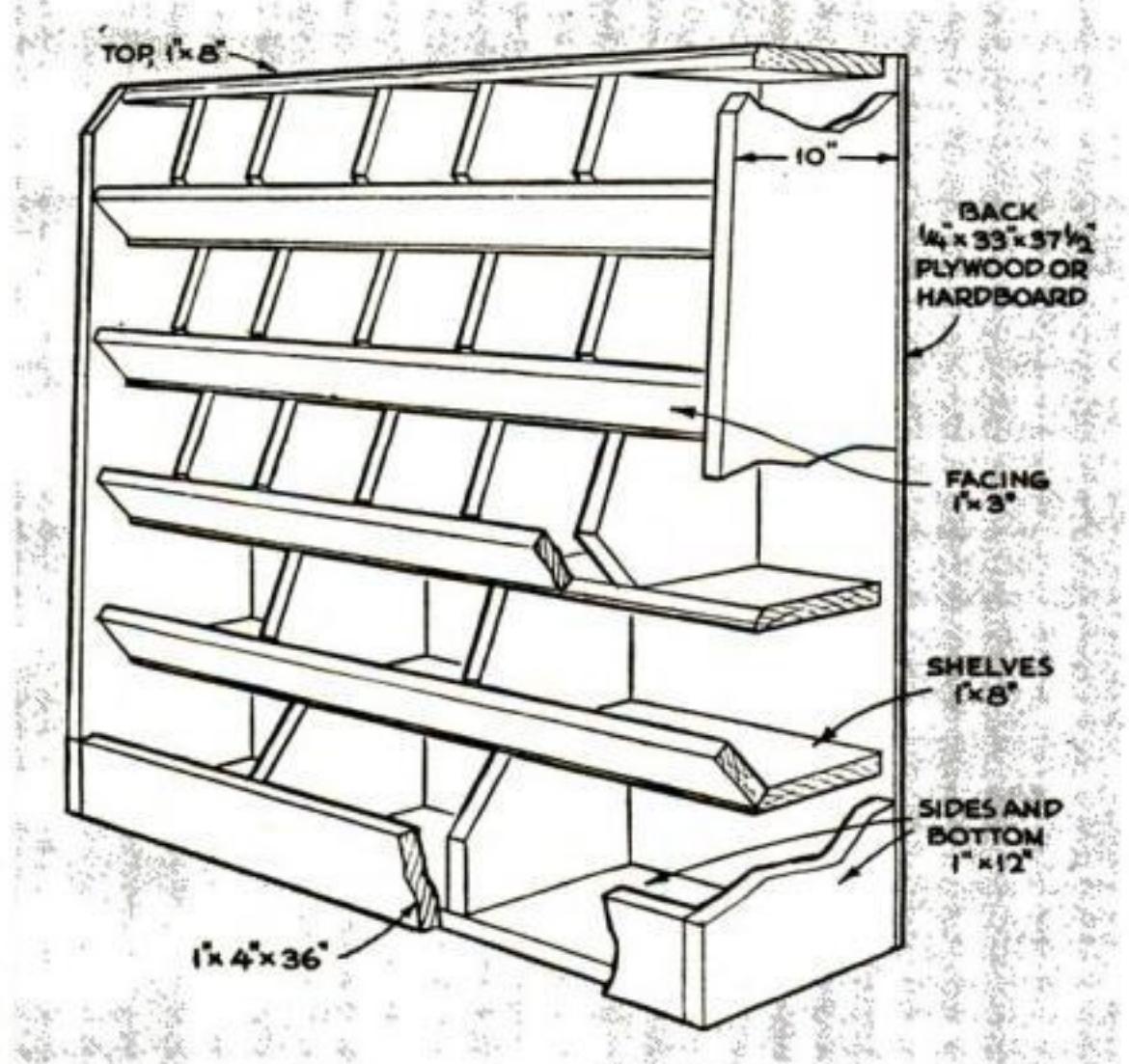
Short Cuts and Tips

FROM PS READERS



Workshop Parts Bin Has 24 Cubbyholes

SYSTEMATIC storage of such items as bolts, spikes, and pipe fittings relieves workshop clutter. This 24-bin unit will bring quick order to the most chaotic shop. Standard lumber is used throughout. The unit is dimensioned for minimum waste. Make a cardboard template of the upper partition pattern to simplify layout. Sand all pieces, and assemble with glue and finishing nails. Labels on the top edges of the face boards will identify bins and speed sorting. (Photo: SpeedWay Div. of Thor Power Tool Co.)—George Sponholtz, Studio City, Calif.

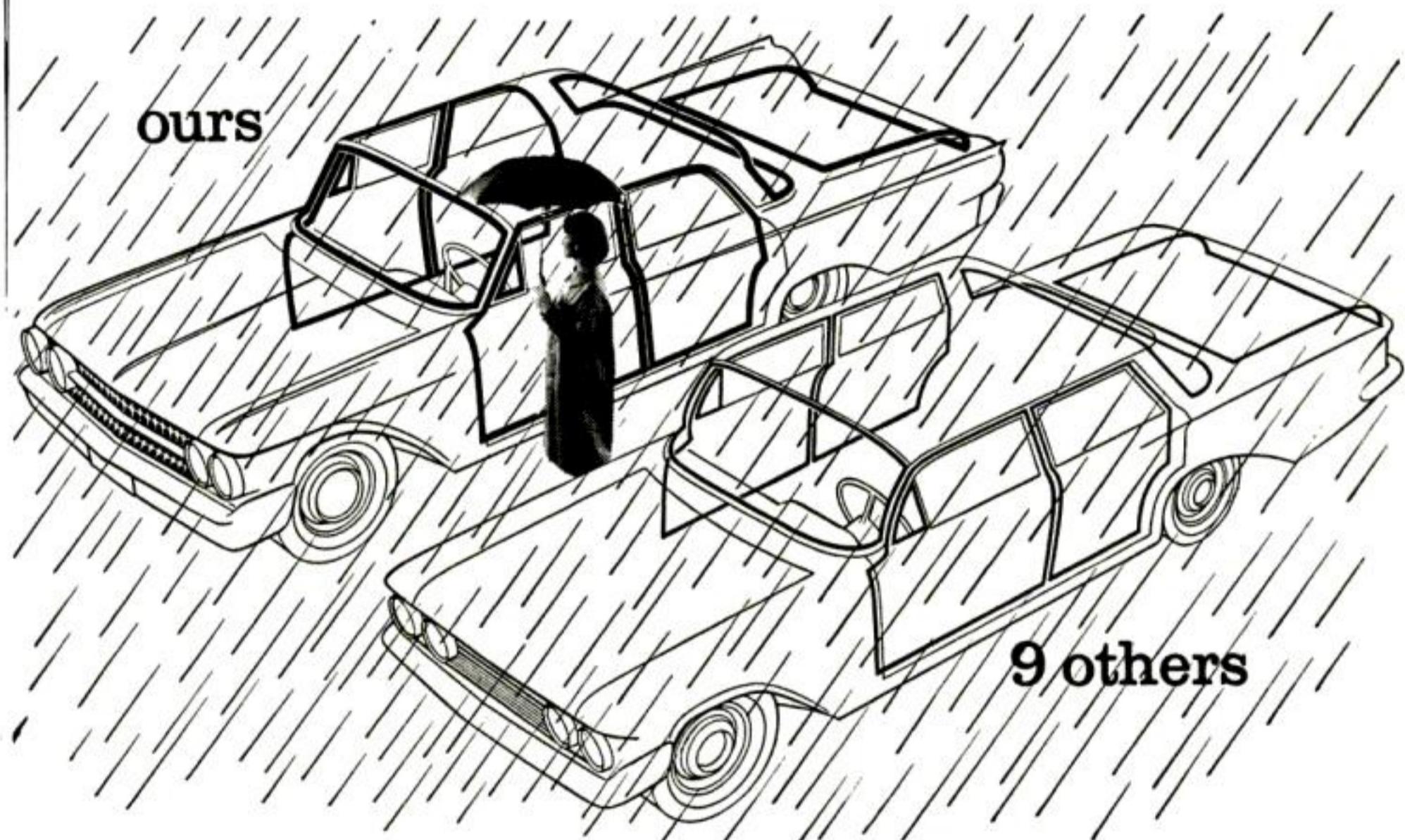


Roll Your Own Washers

SNIP the fingers from a discarded rubber glove, trim away the tips to form a tube, and roll into tight rings. These make good washers for hose couplings.—Harry Wheeler, Toledo, Ohio.

►►►METAL washtubs make good seed trays. Cover the bottom with soil, five or six inches deep, and sink a funnel at the center. Water by pouring into the funnel. Moisture seeps up through the dirt without disturbing seeds or young plants.—Blanche Campbell, Rivera, Calif.

Which body is better sealed?



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These are 4 of the many reasons we think you will find (upon comparing our cars with other cars) that Ford Motor Company builds better bodies.



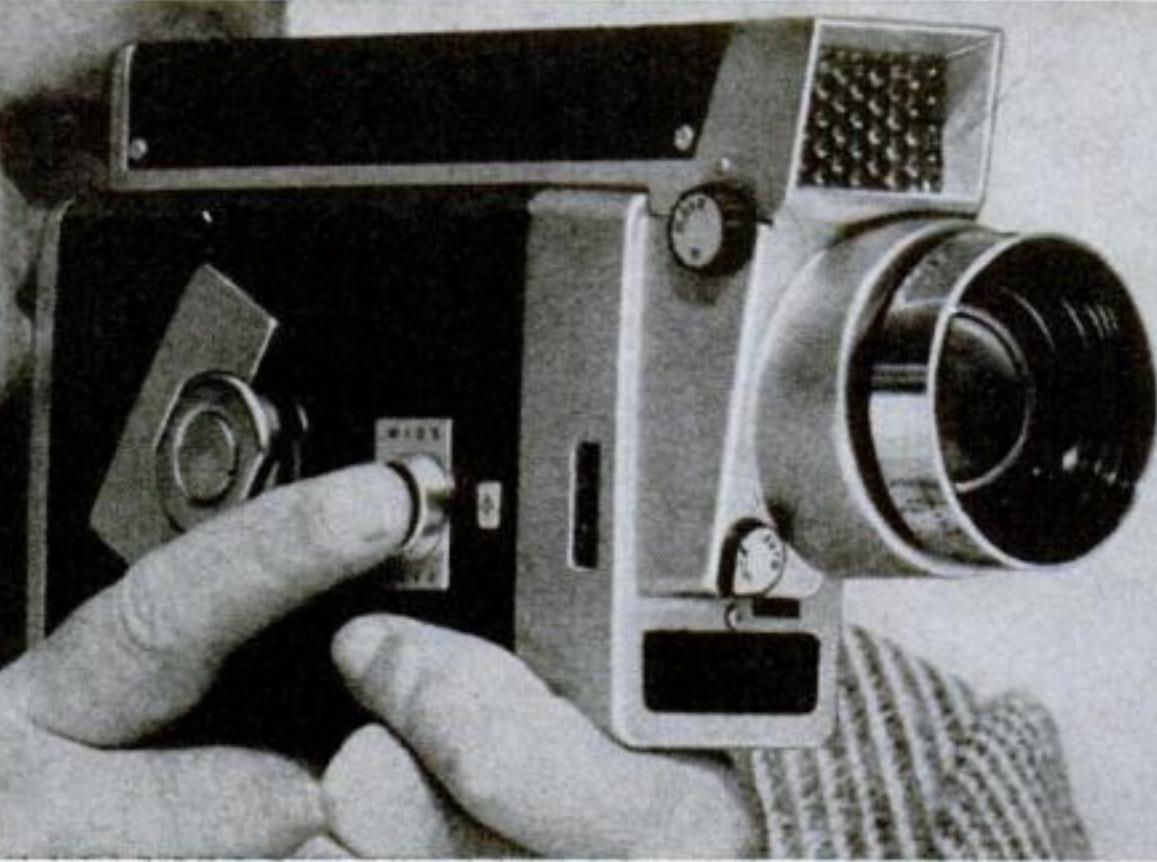
American Road, Dearborn, Michigan

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New Ideas in Photography



EXTREME CLOSE-UP MOVIE ZOOM is simple with Kodak Zoom 8 Reflex Camera. Through-the-lens viewing lets you compose your picture precisely. Low-cost Kodak Portra Lenses, attached to camera lens, let you come as close as 16 inches to your subject.



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Dramatic movie zoom close-ups made easy by new Reflex Camera

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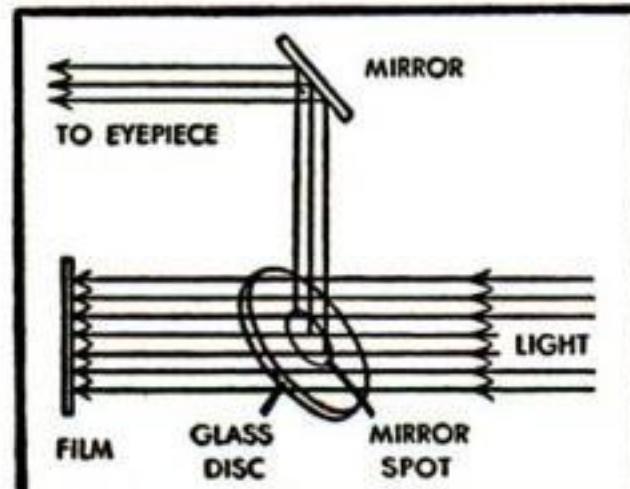
With this movie camera, you can show a face—then safely zoom in for expressive eyes . . . or for a youngster's missing front tooth . . . or for an identifying badge on a cap. You know the framing will be

exactly right! You can picture a flower bed—then zoom in confidently for the center beauty. Or show a single bloom, then zoom in for the butterfly on it!

The camera's motor-driven lens lets you zoom in and out with professional smoothness. Electric eye adjusts exposure automatically. A meter lock lets you switch from automatic to manual exposure control whenever you choose.

Kodak Zoom 8 Reflex Camera is less than \$200. Other Kodak movie cameras from less than \$27.

← **BEAM-SPLITTER** lets you see in viewfinder the exact picture going to the film. It is an angled glass disc with a small translucent mirror spot in the center. Part of the light hitting the spot is reflected to the eyepiece—to produce a sharp, clear image.



from Kodak

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KODAK MOTORMATIC 35, most automatic of the automatics! After each shot, spring motor advances film, cocks shutter. You can click off 10 shots in 10 seconds! For flash pictures 5 to 25 feet from subject, setting focus automatically sets correct lens opening. f/2.8 lens. Shutter speeds from 1/40 to 1/250. Drop-in film loading. Less than \$110.



KODAK AUTOMATIC 35 has f/2.8 lens, two shutter speeds. One-stroke thumb lever quickly advances film. Bright-frame viewfinder lets you frame scene quickly; signals if camera is set for "manual," and if light is too low; also reminds you to wind film. Less than \$90.



KODAK RETINA AUTOMATIC III, newest in the world-famous Retina series. f/2.8 lens. Shutter speeds from 1/30 to 1/500. Fast single-stroke film wind. Coupled rangefinder; complete depth-of-field scale. Shutter release locks if light is too dim. ASA index settings 10 to 1250. Less than \$130.

Prices are subject to change without notice.

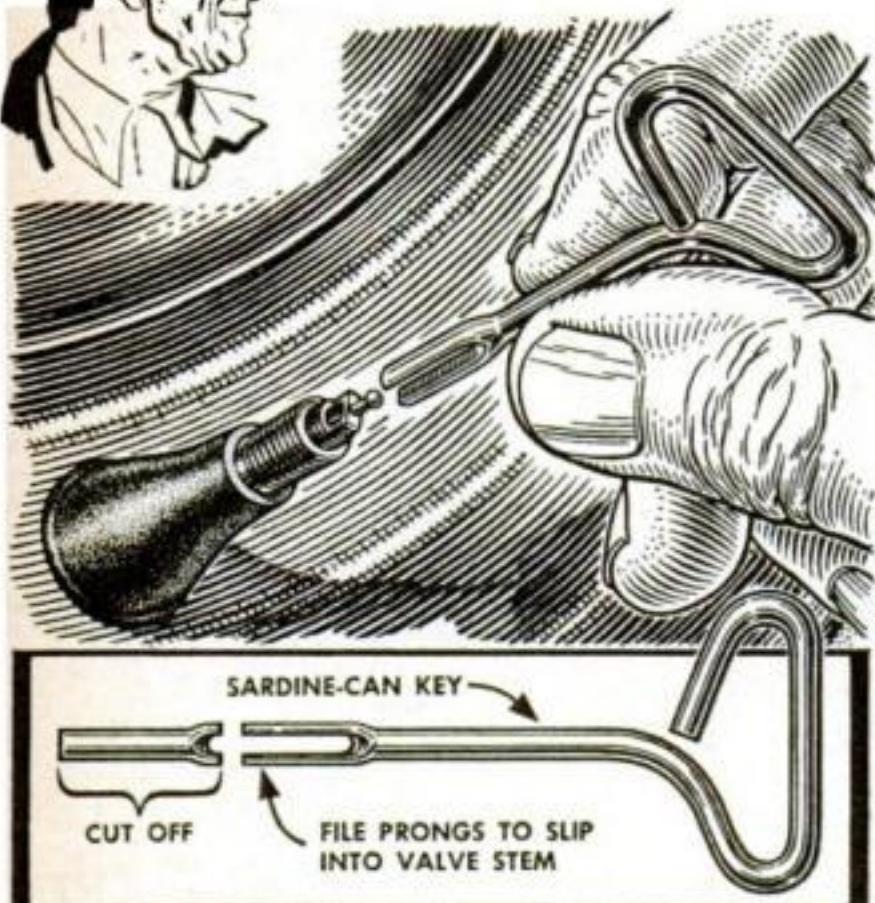
Many dealers offer terms as low as 10% down.

Kodak
TRADEMARK

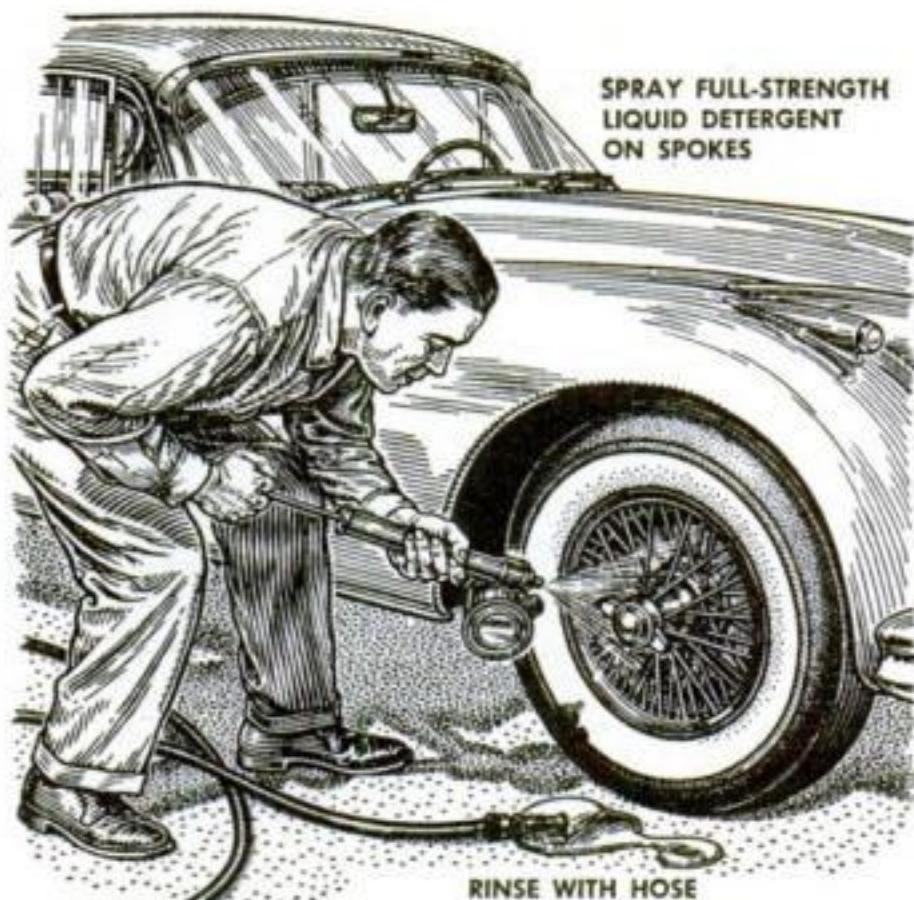
EASTMAN KODAK COMPANY, Rochester 4, N.Y.

See Kodak's "The Ed Sullivan Show" and "The Adventures of Ozzie and Harriet"

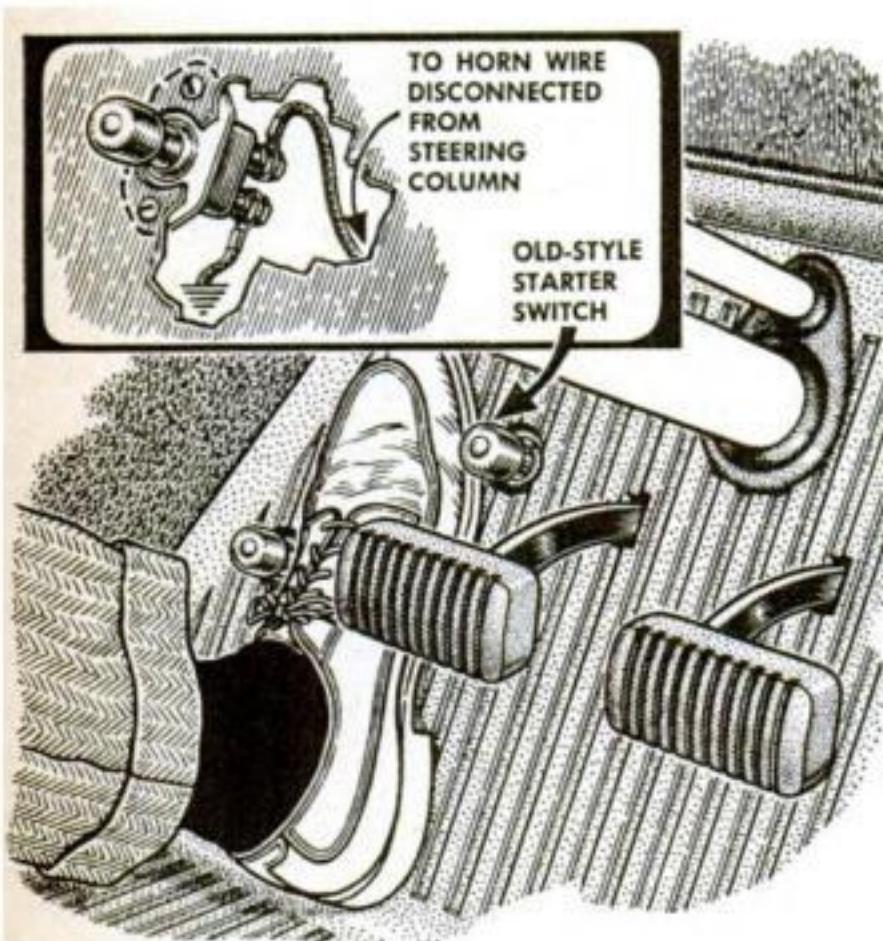
Hints from the Model Garage



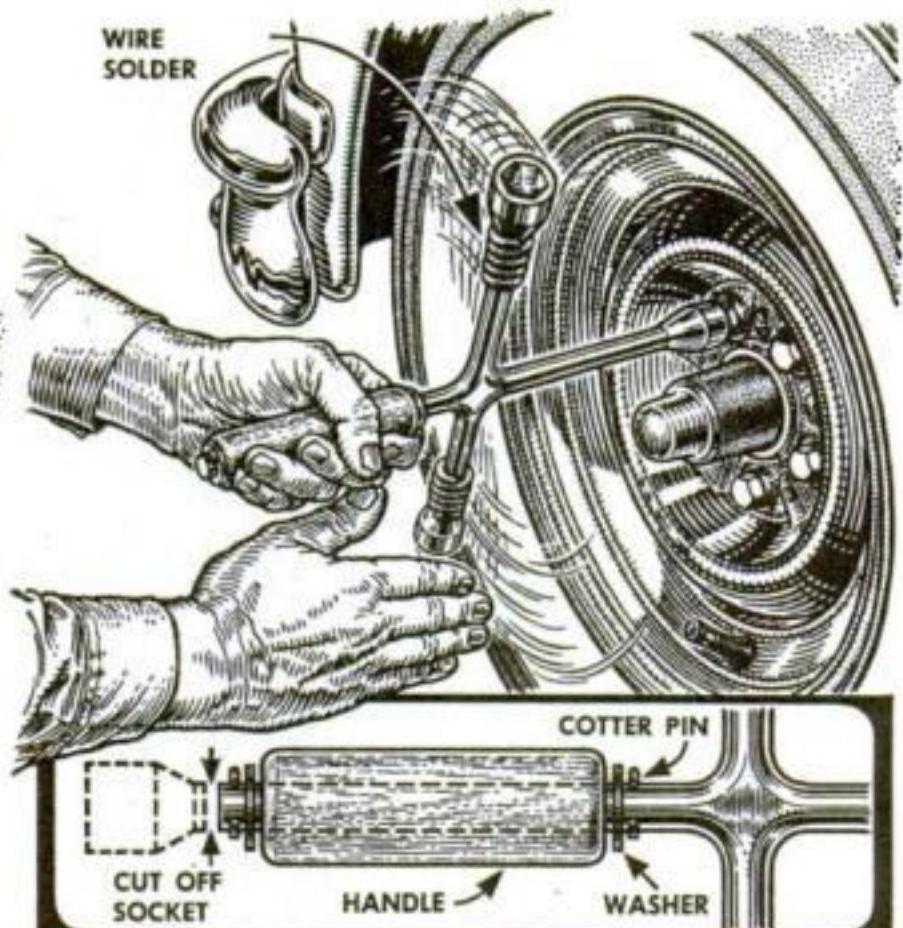
Here's a handy tool for garagemen or motorists. It's a key for removing the core from tire valves. Make it from a sardine-can key by cutting off the end of the slotted part. File the prongs so they slip easily into the valve stem.



Cleaning wire wheels, usually a tedious job, can be speeded by spraying full-strength detergent on them with an insect sprayer. Wait a few minutes for the detergent to work and flush with a garden hose hooked to a hot-water faucet.



If a defective horn button on an older car or truck can't be fixed, substitute a foot switch. An old starter switch, mounted on the floorboard and wired to the horn, can be operated with your left foot. You may even like it better.



Make a speed wrench out of a lug wrench by cutting off the socket opposite the one you use for your car, and adding a wooden handle. Wrap the other two ends with solder to increase the flywheel effect when you spin the wrench.

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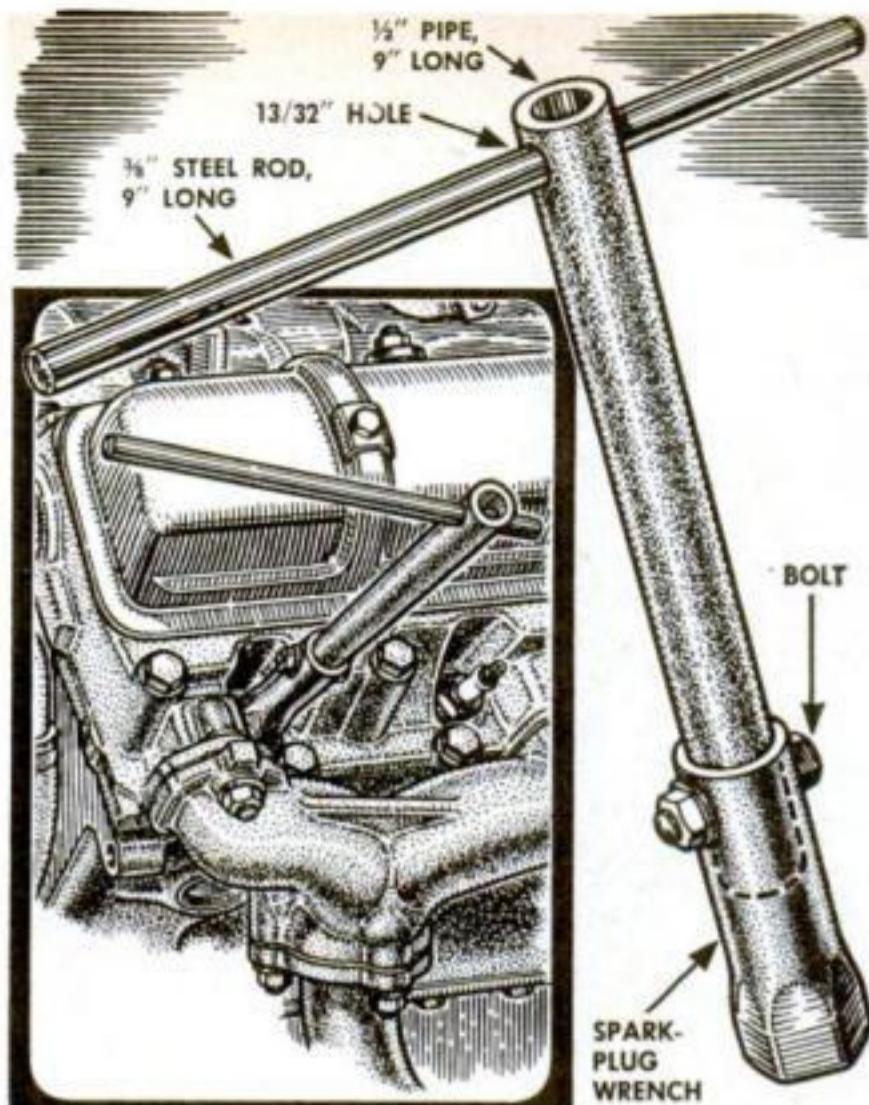
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More Hints from the Model Garage



JOCKEY WHEEL ONTO
HUB WITH SHOVEL

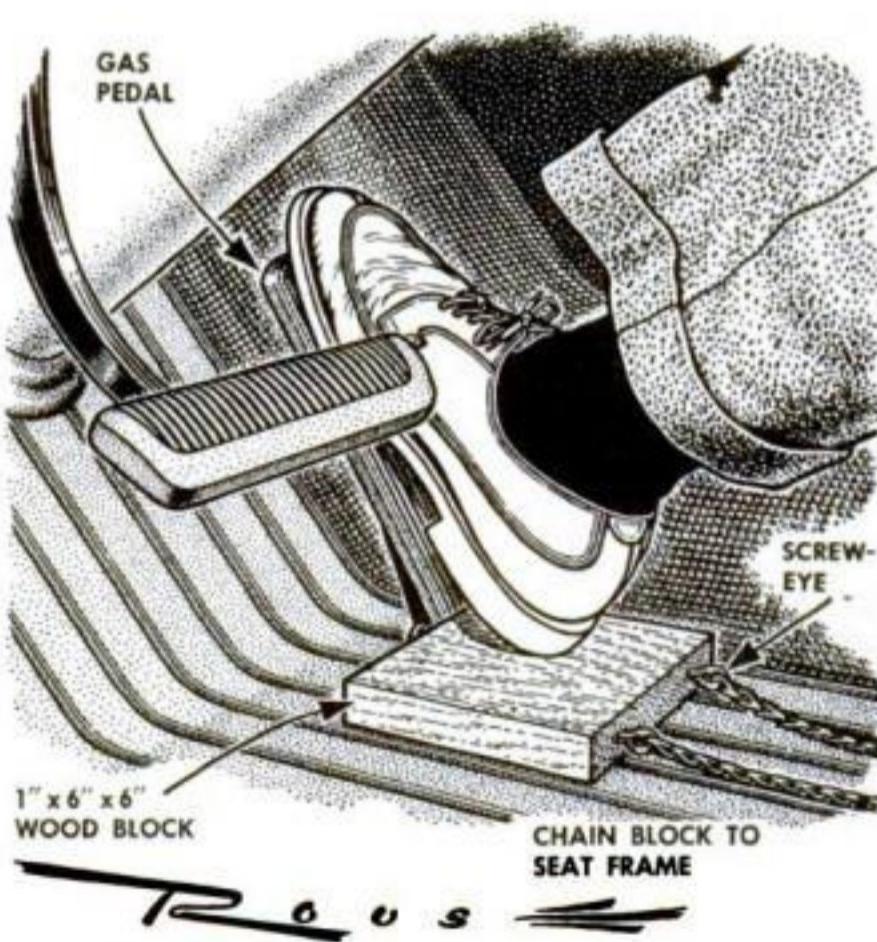
A shovel can make light work of changing a wheel. Slip the shovel under the wheel, pry up and pull out to lift it off the studs. Slide the fresh wheel into position on the shovel and pry up to raise the wheel onto the studs.



A short extension on your spark-plug wrench makes plug replacement easier and may save your wrist from being burned by a hot manifold. Drill holes at both ends of the pipe, one to bolt it to the wrench and the other for a T handle.



Want battery water handy in the garage? Instead of keeping it in a glass bottle, which will shatter if dropped or frozen, use a squeezable plastic ketchup dispenser. The thin spout meters water accurately, eliminating danger of overfilling.



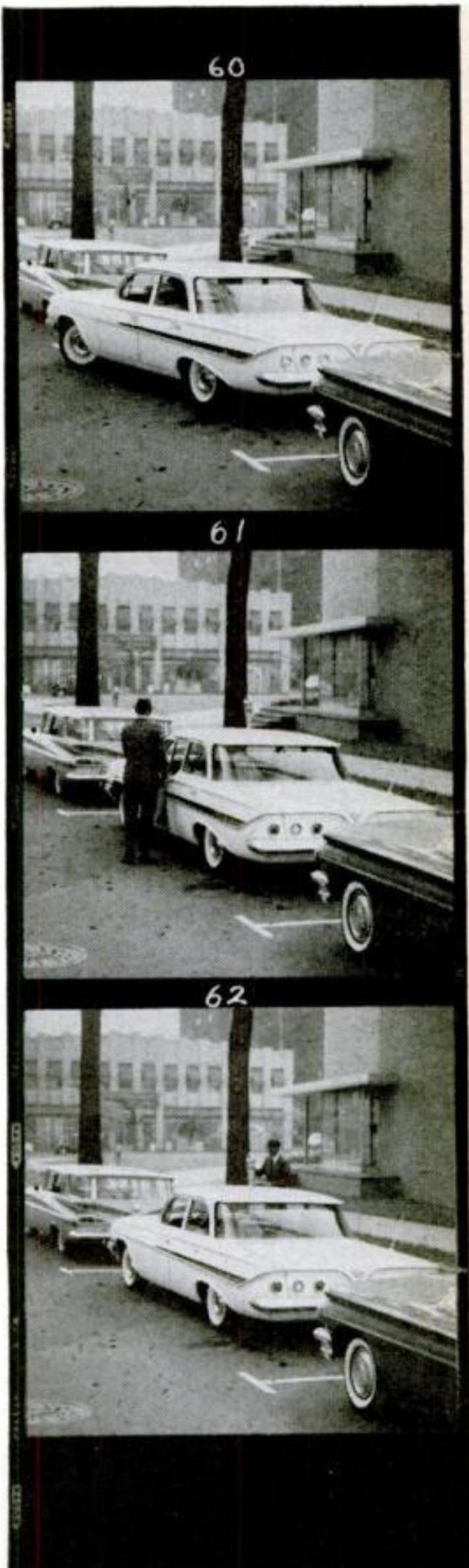
Change the angle of your foot on the gas pedal by resting the heel on a block of wood. It will make long trips less tiring. Chained to the seat frame, the block can't interfere with the brake and can be slid under the seat when not needed.

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Contest opens April 11—closes May 31. Winners will be notified about July 31. Trip can be taken any time during the following 12 months. So drive in and ask for your free spark plug check and entry blank *today!*

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Gus Keeps

"New troubles, Miss Duval?" Gus asked.

The French girl crinkled her dark eyes. "The same one, M'sieu Wilson. Again the horn does not blow."



RAY QUIGLEY

a Lady in Line

By Martin Bunn

AS GUS WILSON waited in line at the state-operated inspection station, a horn beep behind made him look around. From the wheel of a small imported sedan a girl waved a greeting.

The owner of the Model Garage waved back. Madeline Duval, a French exchange teacher, boarded at the house next door to him. He'd met her several times.

It was late afternoon of a warm spring day. The line was long but moved often enough to make waiting drivers keep their engines running. Car after car crept through the station, and Gus's own coupe soon won its inspection sticker, days ahead of the deadline.

Gus drove back to the garage and had just started a finicky ring job when Stan, his young mechanic, interrupted him. "Lady to see you, Boss."

"Can't you take care of it, Stan?"

Stan grinned. "I wouldn't mind. But she asked for you specially, Gus."

Gus walked to the front, his mild annoyance gone as he saw who it was.

"Make out okay at inspection, Miss?"

The young French teacher's pert features twisted in a grimace. "No, M'sieu. It is the horn that does not blow."

"Can't be serious," remarked Gus. "Didn't I hear you blow it back there?"

"Yes, and even now it works." She demonstrated with a brief, ladylike toot. "But when I come to the end of the so-long line, and the man says to blow it, it will not sound."

"Stan, check the fuse holder," ordered Gus. "Look for chafed wiring; clean the button contacts. That should do it."

Gus returned to his ring job and an occasional blast testified that Stan was checking. Soon the little car rolled out.

"Tightened one terminal, Gus," reported Stan. "Oh-oh! Look who's here!"

Gus looked up to see Daisy Allen alighting from her '54 sedan.

"Nothing doing!" said Gus firmly to Stan's mute glance of appeal. "Today Mrs. Allen is your customer."

CONTINUED

185



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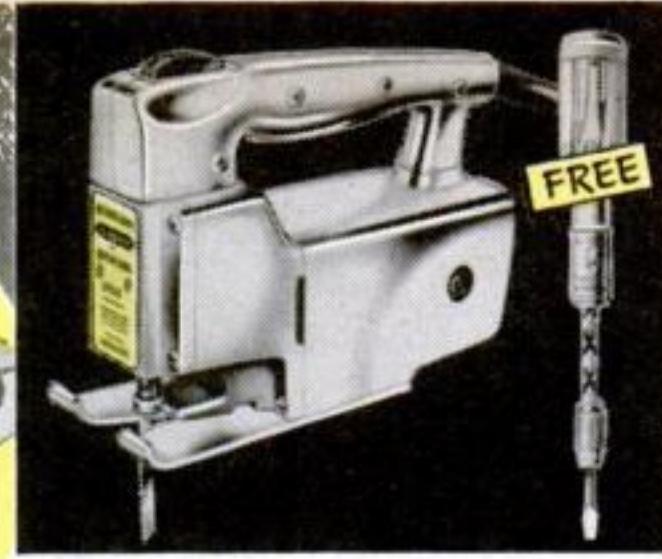
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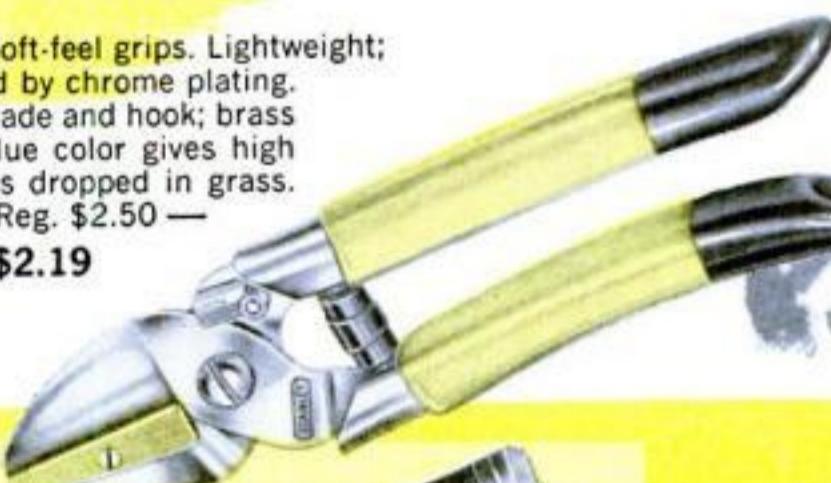
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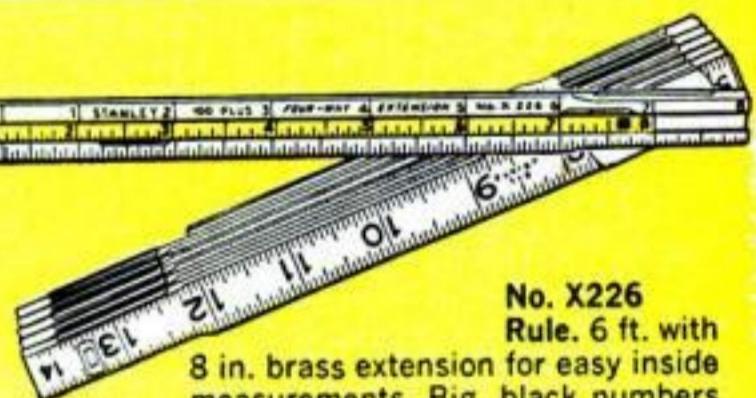
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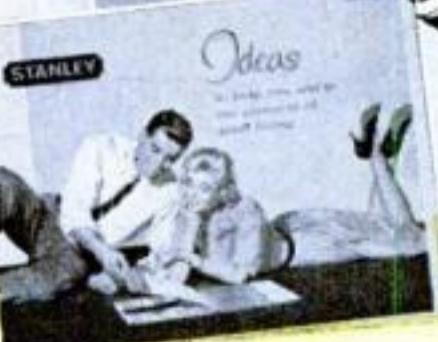
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Stan slunk away. Gus ignored the chirpings of the volatile Mrs. Allen and the mutterings of his harassed helper.

AT CLOSING, Gus turned to Stan. "Not a bad day for me," he remarked. "How'd you do with the Daisy?"

"First she asked whether her hand brake held all four wheels, Gus. I told her only the back two. She said that was just what she thought, and would I please make it looser."

Shrugging out of his coveralls, Gus grinned. "Did you ask her why?"

"Sure. She's commuting to the city for a course or something. When she got home Monday the car had a flat. Today it had two. She was parked on a hill and set the brake hard, so she figures it pinched the tires and squeezed all the air out."

Gus frowned thoughtfully. "Three flats in three days? What did you do?"

Stan reddened. "Slid under with a wrench, then told her the brake would never cause a flat again. Aw, Gus—what else could I do?"

"Not a thing, Stan. A horn that blows except when an inspector's listening, and tires that go flat in pairs! Must be what the papers call the silly season. Let's just hope it's over."

THE next day promised at first to be free of odd complaints. But about four o'clock a plaintive beep sounded in the shop. Gus himself responded.

"New troubles, Miss Duval?"

The French girl crinkled her dark eyes. "The same one, M'sieu Wilson. I arrive at the last moment in the line, and again the horn does not blow."

"We'll double-check and you can still

get back before they close for the day."

"It is the final day. I put it off too long. Now—pouf!—time is out."

Well aware that state law was rigid on this point, Gus traced every visible inch of the horn wiring, cleaned the button contacts again, and replaced the fuse on the off chance that it had an intermittent break inside. The horn gave a pert, clear warning every time.

"I'll send Stan with you, Miss Duval," he told the young teacher. "If you have trouble, he can fix it on the spot."

Once the little car had scurried out, Gus began closing. Then the phone rang.

"Oh, no!" he murmured. "It can't be—" But it was Daisy Allen, her flutterings really in high gear this time.

". . . told your young man the brake was too tight, and now I have four flat tires at once and I'm simply desperate because yesterday I had a spare and an extra snow tire in the trunk but now—"

Gus did some quick thinking. The odds against four tires going flat at the same time were monumental.

"Relax, Mrs. Allen," he said. "It may take me some

time. Where are you parked?"

After she had told him, Gus inflated a couple of big spare tires somewhat above normal. He was loading them into his car when the phone rang again.

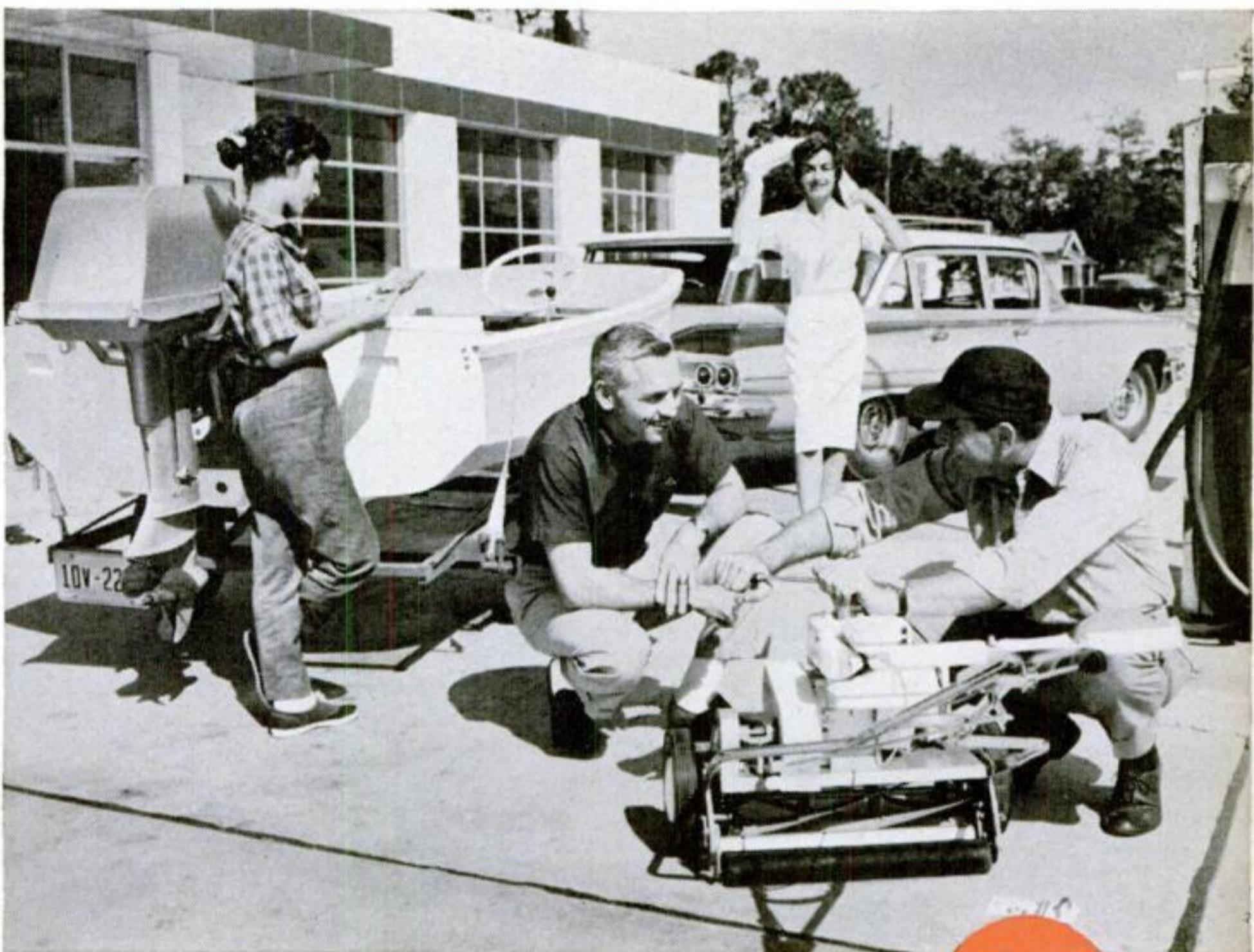
"Gus," said Stan desperately, "it worked fine all the way here. I even tooted it while we waited in the line. When we got to the inspector, not a peep. If we don't get it fixed in 20 minutes, her registration will be void and she can't use the car tomorrow."

"Does it work now?" asked Gus.

"Hold it!" The phone was silent; then

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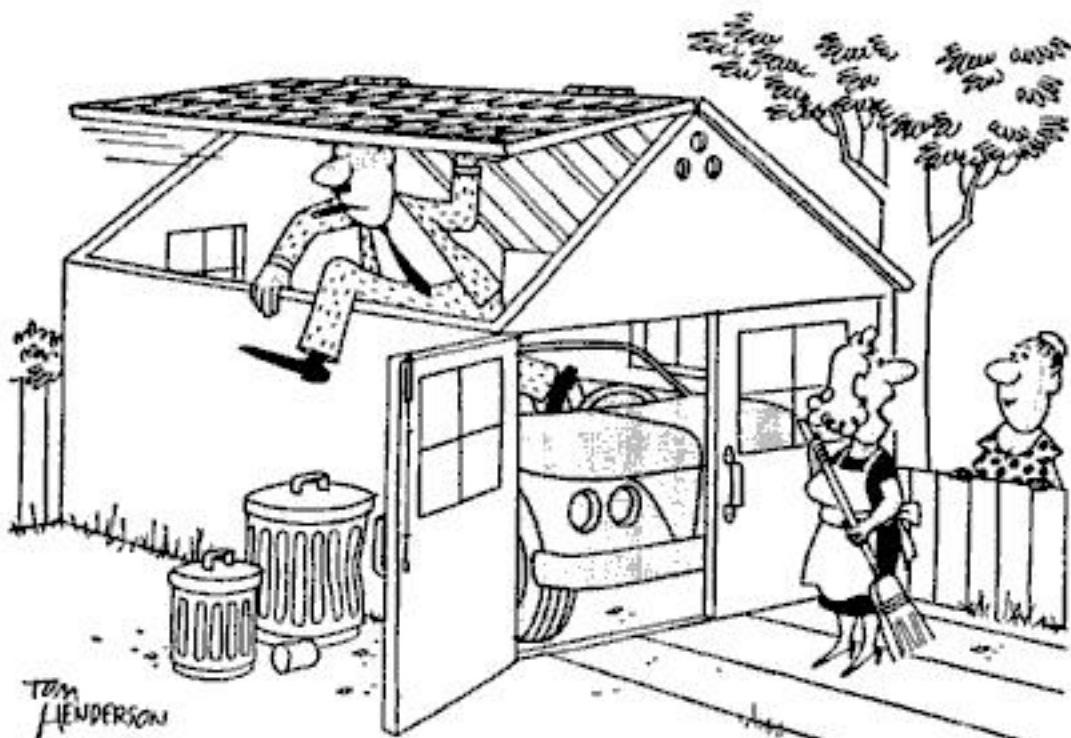
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a soft beep traveled over the wire. "It works now! That car's spooked."

"By a pretty spook," mused Gus, recalling the slow progress of the inspection line, the idling engines waiting each advance, the day's warmth stretching into the afternoon.

"Got an idea, Stan. No time for anything else. Now do this . . ."

GUS drove to the spot Mrs. Allen had described—a steep dead-end with a small factory on one side and a warehouse on the other. Both were closed. The only car in sight was Daisy Allen's. In midstreet, far from the curb, it



"What we'd like now is a bigger garage."

squatted forlornly on four very flat tires.

She emerged from it in mid-sentence. ". . . So glad you came, Mr. Wilson, because it's harrowing to be so utterly helpless, as you see, and . . ."

Switching off his ears, Gus found without surprise that all four valve stems were loose. He tightened them, and briefly coupled a short hose from each flat tire to one of his well-inflated spares. Soon the car was on its feet.

"Now, Mrs. Allen," he said grimly, "you drive to the nearest gas station and get your tires properly inflated."

"Is that all? Thank you ever so much. Tomorrow I'll leave the car for you to adjust that horrid hand brake—"

"It isn't the hand brake, Mrs. Allen," said Gus firmly. "It's you."

"I? Whatever do you mean?"

"Is this where you left the car?"

"Of course. I couldn't park near the curb, because of all those others."

"So you parked with cars on three sides—and of course locked yours?"

"Certainly. I always lock it . . ."

"Mrs. Allen, when the fellows who work here got through, probably at four, your car blocked several of theirs. On Monday they left you a hint—one flat tire. Yesterday they made the hint broader—two. This time, to make sure you got the message—four."

"But that's—that's sabotage!"

"Yes, ma'am," said Gus mildly. "And parking the way you did was downright thoughtless. But for all the backing and filling they had to do to get out, they didn't put a scratch on your car."

Daisy Allen meditated briefly. "It is wonderful how you men can maneuver cars. And you're so right—I will never park so carelessly again."

"Keep that promise," said Gus, his fingers crossed, "and I won't charge for adjusting your hand brake yesterday."

RETURNING to leave his car at the shop, Gus found Stan ready to go.

"You figured that spook right, Boss. Idling in line hotted up the engine, and, running slow, the fan spread hot air around the horn. Guess the contact mount or diaphragm expanded enough to spoil the vibrator-point adjustment."

"And Miss Duval got her sticker?"

"Sure. Soon as we got into line I had her cut the engine, and I pushed her car along as the line moved. The horn stayed cool and blew fine. Afterwards I adjusted it to blow hot or cold."

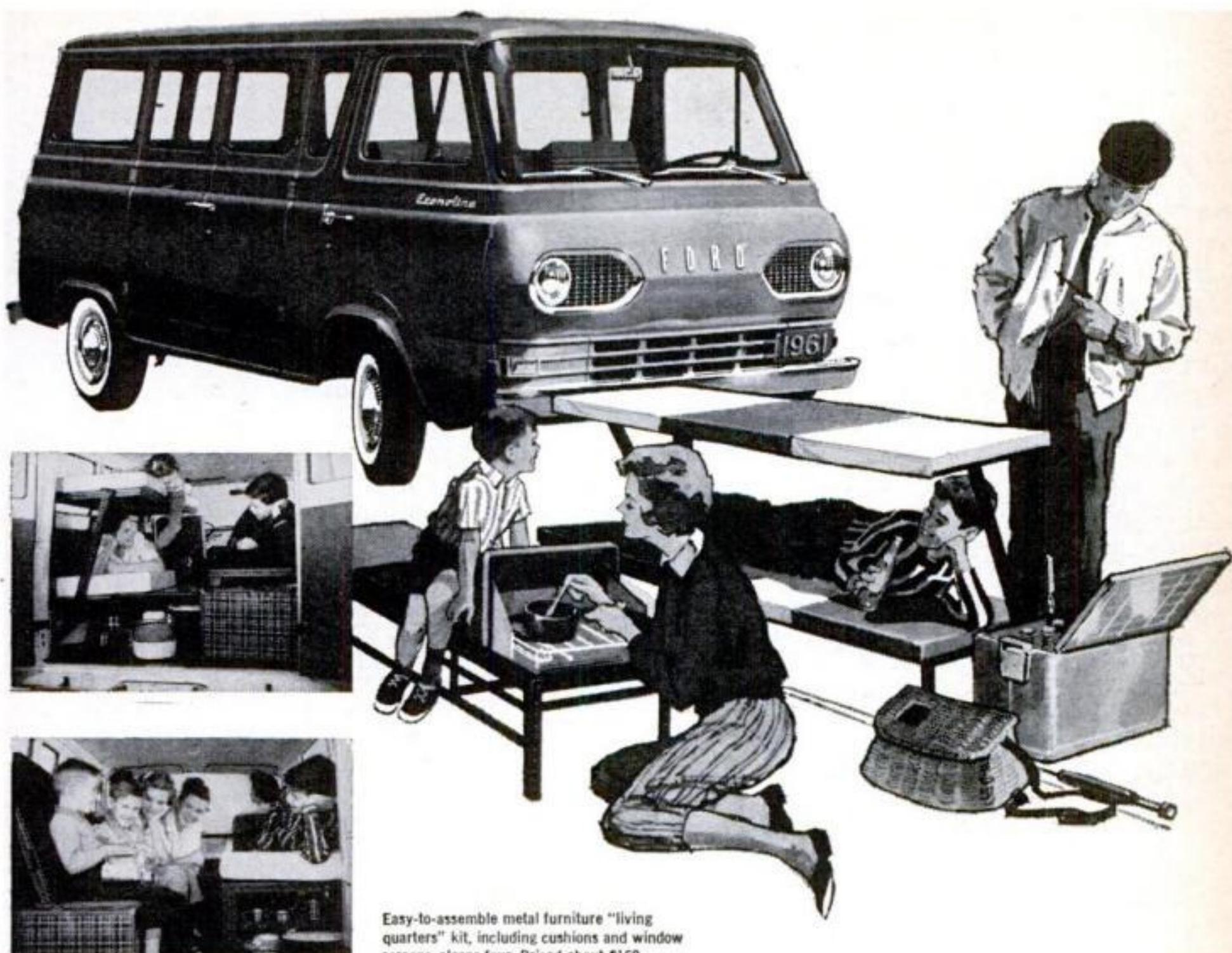
At the door, Stan turned back. "Uh, Boss—I didn't know what to charge. You know where she lives? I could take the bill around tonight."

"Don't bother, Stan. I'll send it to Washington myself."

"Washington? I thought she lived around here," said Stan glumly.

"She does," returned Gus, his eyes twinkling. "But who else should pay for such a good job of foreign aid?"

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pliances are your second most valuable trouble-shooting aid, you'll want to start accumulating them as soon as you're familiar with your test meter. Here is the most useful information to record:

- Automatic major appliances (clothes washer, dryer, dishwasher). Run the machine through a complete cycle. At each stage, take a voltage reading at each terminal of the timer switch, all solenoids, switches, and the motor. Pasted on the back, or inside, of most recent models, you'll find a circuit diagram that will help you trace the wiring. After the voltage check, pull the plug, or remove the circuit fuse if the machine is permanently wired, and measure the resistance of all solenoids, motor windings, and heating elements.
- Small heating appliances (toasters, irons, coffee pots, waffle irons, heating pads). Measure the resistance between the two connecting prongs when the appliance is cold.

● Small motor-driven appliances (fans, tools, mixers, electric clocks). Check the resistance at the plug with the plug out of the outlet and the appliance switch (if there is one) turned on. If your meter will handle the current, check current draw with a normal load on the motor.

Spotting potential troubles. Periodic checks may show either an increase or decrease in the normal resistance of heating appliances. If the resistance is higher, check for loose or corroded terminal screws holding the heating element, or dirty contacts on the built-in thermostat. A drop in resistance is normal with aging. When the drop reaches 10 to 15 percent it's a warning to be prepared for the element to burn out. If there is a sudden marked drop it may indicate that the element has sagged and is shorting out part of the resistance wire.

Current consumed by a motor is a clue to possible mechanical troubles. If you find higher-than-normal current draw, check for dry or worn bearings, excessive friction in the drive train, or possibly, in a washing machine, congealed gunk clogging a pump impeller or main agitator bearing.

Surveying your house wiring. Handiest instrument for this is the clamp-

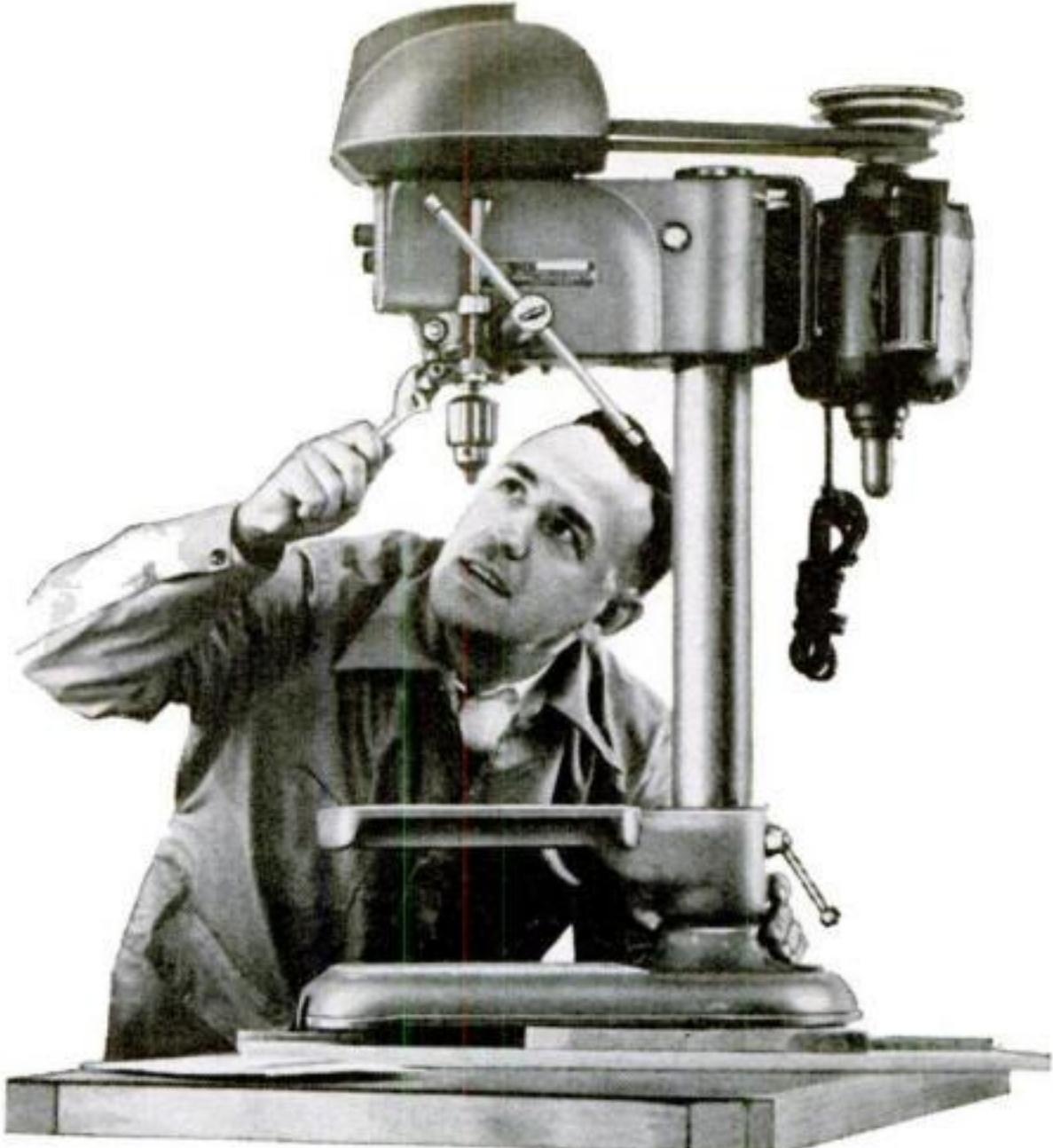
around ammeter. Simply by snapping it around a single wire at the fuse panel, you can quickly check the load on any circuit. Turn on all devices fed by a particular circuit and read the load. If the current is uncomfortably close to 15 amps for a circuit with 14-gauge conductors (20 amps for 12-gauge), explore the possibility of switching some of the load to a less heavily used circuit. If that's not feasible, you need extra circuits.

Voltage drop over a long, heavily loaded branch circuit can be a constant source of trouble—particularly for TV sets and air conditioners. Check the voltage at the fuse panel and at the outlet with all attached devices operating. If the voltage at the outlet is more than 10 percent low, you need heavier wiring unless you can switch some of the load to another circuit.

When an appliance quits. If you've done your homework and have the records to go by, isolating the offending parts of even a complex automatic device is as easy as repeating your original measurements. But before you open the patient, check the voltage at the outlet. If there is none, your problem is likely to be solved simply by replacing the fuse. If, when checking voltages inside the machine, you find a point that gives no reading when your record shows it should, pull the plug and trace back through the circuit with the ohmmeter to pinpoint the fault. If all voltages read okay, then your trouble will probably show up when you measure the resistance of the various parts.

For small heating appliances, all you do is use the ohmmeter to check electrical continuity through the plug, line cord, switch, thermostat, and heating elements. Also check the resistance between one conductor terminal and the metal case for accidental grounds. The meter should give no indication on this test. If it does, look for sagging elements, stray strands of wire touching the case, or charred insulating bushings where the connecting prongs enter the case.

Use the same procedure for a small motor-driven appliance. If resistance and continuity checks are in order and it still doesn't run, look for mechanical troubles.



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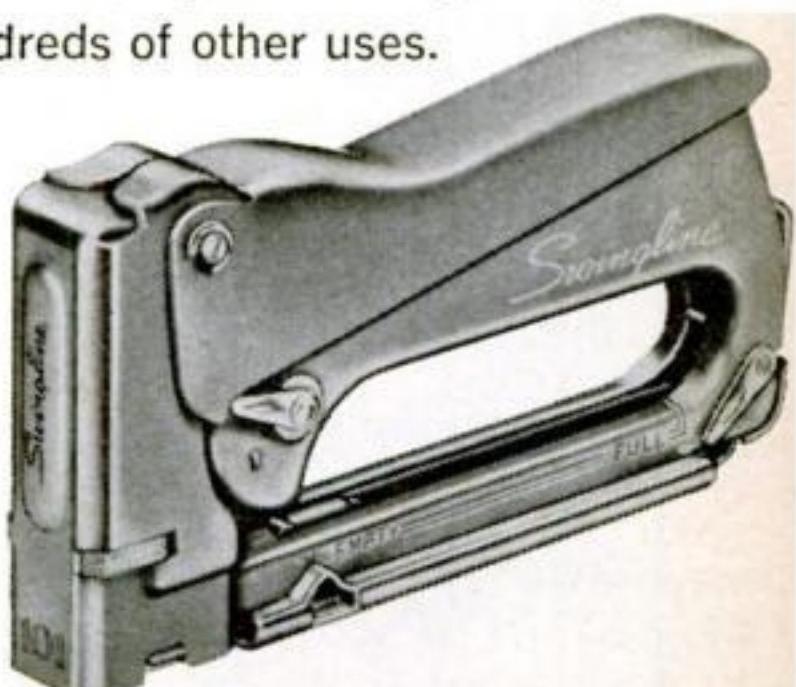
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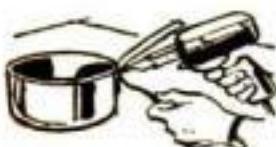
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Men in Florida 10,000 Years Ago?

[Continued from page 67]

But the most spectacular find of all occurred not 20 feet away from the log and just above it in the grayer, less-dense silt of Layer 2: an intact human skull. When it was removed on July 11, 1959, some white material was noticed inside. It was soft and rounded-looking for all the world like brain tissue.

So agreed three biologists and a physician who later examined it in the lab. Remarkably fresh tissue, they added.

The brain was removed and fragments were sent to Sarasota Memorial Hospital. Not only did neurosurgeons there agree that the material had the form of a brain, but they were able to distinguish parts of cerebellum from cerebrum, parts of gray matter from white.

Now an interesting development occurred. A pathologist, John S. Bracken, made a microscopic examination of a portion of stained tissue but could find no cellular structure. Other tests showed the presence of some mineral material. Apparently the original brain tissue had been preserved naturally for a long period and then had started to be replaced by the surrounding sediment—but without disturbing the general configuration. The specimen was part pure brain tissue, part mineralized.

How was it preserved? Scientists have recorded instances of 1,000-year preservation of tissue in Peruvian and Egyptian mummies, and in cadavers recovered from peat bogs. But the brain from Warm Mineral Springs was different. It appears to be the first case of long-term preservation taking place naturally, in water, even though the brain originally may have been in a dry environment. This could happen if the water or the sediment contained specific antibiotics.

What about artifacts? So far two bone needles, an antler-shaft wrench, a bone pestle, and part of a fossil shark's tooth with a chipped edge have been recovered. These plus the evidence of the charred log alone add up to impressive history: As far back as 80 centuries B.C., as far back as 20 centuries before the Egyptians or the Mesopotamians entered the New Stone Age, men who built fires and made tools lived in the New World. In Florida, to be precise.

Answers to PS Puzzlers on 24 and 26

A pinch of poison. If Watts did it, then his first statement is false and the other two must be true. Then Rogers' statement 1 is false: He couldn't be sitting across from Smith if Watts and O'Neill were sitting next to each other. Statement 2 would also be false since it contradicts Watts' statement 3. That's too many untruths. So Watts is not the murderer. Suppose Rogers is. But that would make O'Neill's first two statements false. That leaves O'Neill as the murderer, in which case we have this set of true and false statements: O'Neill: 1 T, 2 F, 3 T. Watts: 1 T, 2 T, 3 F. Rogers: 1 F, 2 T, 3 T.

Family ages. Let D=Dad's age and J=Junior's age. Then four years ago:

$$D-4=4 \quad (J-4)$$

And right now: D=3J

So:

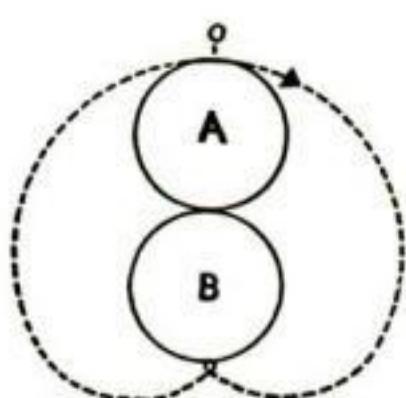
$$3J-4=4 \quad J-16$$

$$J=12$$

$$D=36$$

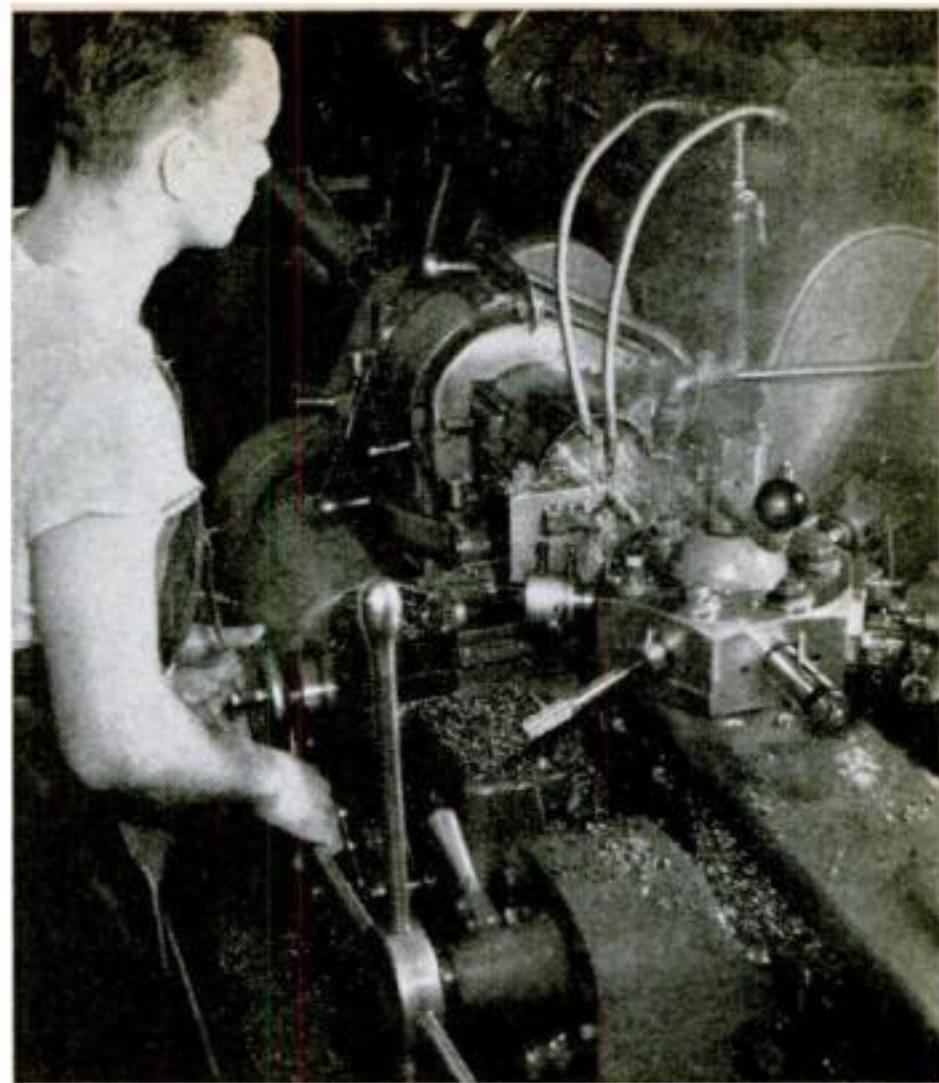
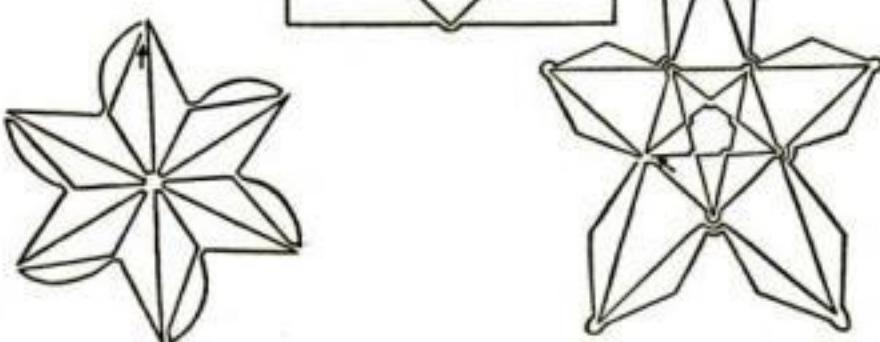
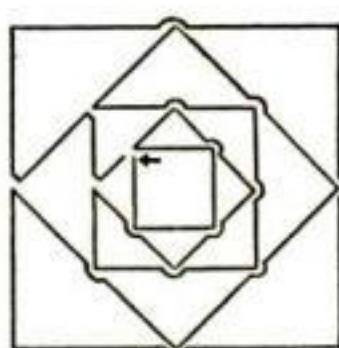
In eight years Junior will be 20, so Mom will be 40. That makes her 32 now.

Hungry bookworm. Only $2\frac{1}{2}$ inches. With the books in order on the shelf, the first page of Volume I comes just to the left of Volume II while the last page of Volume III flanks Volume II immediately on the right. $\frac{1}{8} + \frac{1}{8} + 2 + \frac{1}{8} + \frac{1}{8} = 2\frac{1}{2}$ inches.



Wheels. Two complete revolutions. Try it with a pair of quarters. If you mark a point at the top of the moving coin and then roll the quarter half-way around, you'll see that the point is at the top again—just touching the bottommost part of the fixed coin. The path that the point moves in is a tricky curve called an epicycloid, the dashed line in the sketch.

Doodle problems.



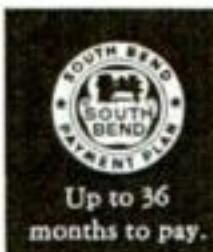
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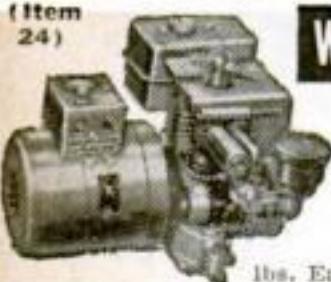
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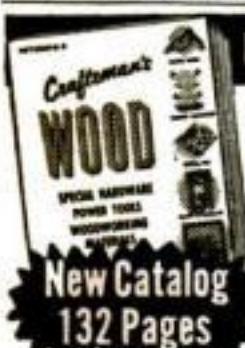
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How a "Black Box" Can Help Find Fish

[Continued from page 81]

likely to be found in depths to 10 feet in lakes where the water level remains fairly stable, particularly during the spring or summer breeding seasons when warm-water fish lay their eggs near shore. Cold-water fish generally spawn during the fall and early winter, laying their eggs on the bottom in a nest of gravel.

Where the fish are. How does a depth finder and this knowledge of fish habits help you pick a likely fishing spot? Well, you use the additional fact that, besides thriving at certain water depths, fish also seek out specific habitats. If, for example, your depth sounder in a deep, cold lake shows an abrupt rise from deep to shallow water, and the upgrade is rocky, you are most likely to hook into a big lake trout just at the edge of the shelf where the water is the deepest. If the instrument has been giving a steady reading at about 90 feet and then the echoes suddenly shift to 85, 75, and on up to 50, where the soundings level off, you've found a potential hot spot. You can bet that if there are any lake trout to be caught they'll be patrolling this slope. It is a typical setting where big lake trout stalk schools of small red or sockeye salmon. The situation fits a logical pattern. The sockeye feed on water fleas, copepods, and other crustaceans, and the big lunker lake trout feed on the sockeye.

Season is important. If you were to fish this same lake in the early spring just after the ice breakup, or in the late fall when the water is getting close to the freezing point again, you'd still watch your sounder. But this time you would stick to shallower water, because at these times of year the salmonoids cruise and feed close to the surface.

In general, slopes, holes, and tables attract fish because fish like to stick close to their source of food. A 20-foot gully adjacent to lily pads or grass will, like as not, be a staging area for bass, pike, or pickerel. The grass and lily pads will have larvae and snails clinging to their undersides. Flying insects will use the top of the vegetation as resting spots. Frogs will be attracted to the insects and minnows to the larvae. So the bass will loaf down in the gully and from time to time move up from the protection of that

How a "Black Box" Can Help Find Fish
depth to this convenient canteen with its varied menu.

A depth finder will also give fishermen another important clue: whether the bottom is rocky, muddy, or hard and flat. The band of light that appears on the indicator tells you about it, too.

On the Raytheon Fathometer that I've used, for example, a wide, steady band of red-orange light indicates a muddy bottom. The depth reading is taken at the leading, or shallower, side of the band. If the light holds position but flickers, there's an uneven rocky bottom. Here again the shallowest reading is the

.....
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.....

true depth. When the light is bright and unwavering you can be sure that the bottom is as hard and flat as a gymnasium floor. With a knowledge of the type of bottom that certain fish seek out, you know at once how good your chances are.

Salt water, too. A depth finder is also handy for the salt-water fisherman looking for such inshore species as flounder, weakfish, snapper, and snook. A sunken derelict is always a lively location. (You'll find wrecks marked on nautical charts.) A depth finder will enable you to pinpoint the exact location.

Trenches, gullies, and shallow areas are easy to locate with an electronic probe. Even during the angling doldrums, these areas are often productive spots. Coral reefs reflect sharp signals and inevitably produce considerable fish traffic. Pompano, flounder, and whiting that move into the flats at high tide migrate back to the edges of channels during low water. Edges of channels are seldom well defined. In many areas markers are a half-mile or more apart. Yet with a depth sounder you can stalk the fringe of a channel with as efficient underwater eyes as those used by your prey.

So try the electronic-probe approach to angling. If you don't double your normal catch, call me a big-mouthed gastropod.

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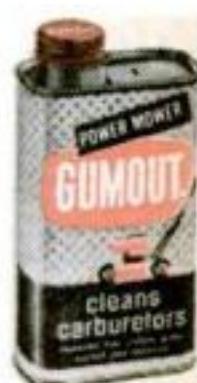
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And a good many customers cooperated.

One—let's call him Mr. Brown—reported to his insurance company:

"At 10 p.m. on Dec. 23 I was driving my Pontiac and realized I was on the wrong road. I pulled right for a U turn. In turning, I hit Mr. Y's car. The impact threw Y out of control. He ran off the left side, hit several trees, rolling over and coming to rest on his right side. Nobody was hurt."

Claims like this were so convincing that the insurance companies were fooled into paying \$39,000 in eight months. And the claim quoted above sounded so real that Mr. Brown's insurance company was about to pay \$1,800 to repair the wreck he'd "hit."

It might have gone through had not the ringleaders tried to "go for more." The money was coming so easily that they suddenly "discovered" that Brown had also hit a third car at the same time. Brown sent in a report to this effect.

This was too much. Claims Bureau agents were put on the case, the racket was exposed—and 31 persons, including some 20 customers—went to jail.

All in the family. Agents brand fakers as "the lowest form of life." Some are willing to take fantastic chances, even with the lives of their wives and children. One man was caught after he'd put his daughters in one car and then caused their car to smash into his—so all could claim injury.

One night, near Fort Hancock, Tex., an ex-convict put his wife and nephew in a car and went out to "have an accident." Soon they spotted a flat-bed truck tooling along U.S. 80 with a heavy tractor aboard. The truck was California-bound and its driver was trying to be careful.

He noticed a black Ford, which kept passing and then slowing down, forcing him to shift down to a crawl. He had no way of knowing that the Ford driver was baiting him, trying to get him mad.

The truck driver refused to be baited. Suddenly the Ford came to a dead stop. Caught by surprise, the truck driver couldn't quite stop. "I gave her straight air," he said. But he hit the Ford a light blow, mashing the trunk.

"I ran to the car," he said. "The driver and his two passengers, a man and a

woman, were holding their necks. The woman said she might need to be taken to a hospital."

She didn't, of course. The trio were all in fine health. But to stave off a lawsuit, the trucker's insurance company ponied up \$1,000.

Payoff postscript. Word of this crash reached Claims Bureau agents. Their first act was to check with another quiet agency, also almost unknown to the public. This is the insurance industry's "Index System," which maintains card files, in nine key U.S. cities, showing injury awards. Sure enough, the Index files in Dallas showed that the three people in the Ford had claimed \$20,000 for a series of accidents—all in three years.

"We felt sure they would strike again," says an agent. "But we couldn't guess where. Meanwhile we began finding out all about them." Insurance companies everywhere were alerted. Both men were found to have crime records. FBI-type "wanted" bulletins were sent out.

Two months passed. Then one afternoon on U.S. 67, near Fredericktown, Mo., a white Chevrolet raced past a truck at 90 miles an hour—and slowed to a crawl. It was the same three people, up to their old tricks.

After 40 miles of harassing the truck driver, the Chevrolet slid to a stop.

This time, however, its driver miscalculated. The crash was worse than intended. The truck jackknifed, skidded, tossed the Chevrolet into a ditch. The fakers were now playing close to murder.

Luckily the truck stayed upright, its driver unhurt. And the woman and the two men, by some miracle, crawled out of their own car unhurt.

But luck had run out for the fakers. When their claims were filed, agents closed in. Both truck drivers testified, and the three accident artists went to jail. One subsequently escaped—and may soon be up to his old tricks.

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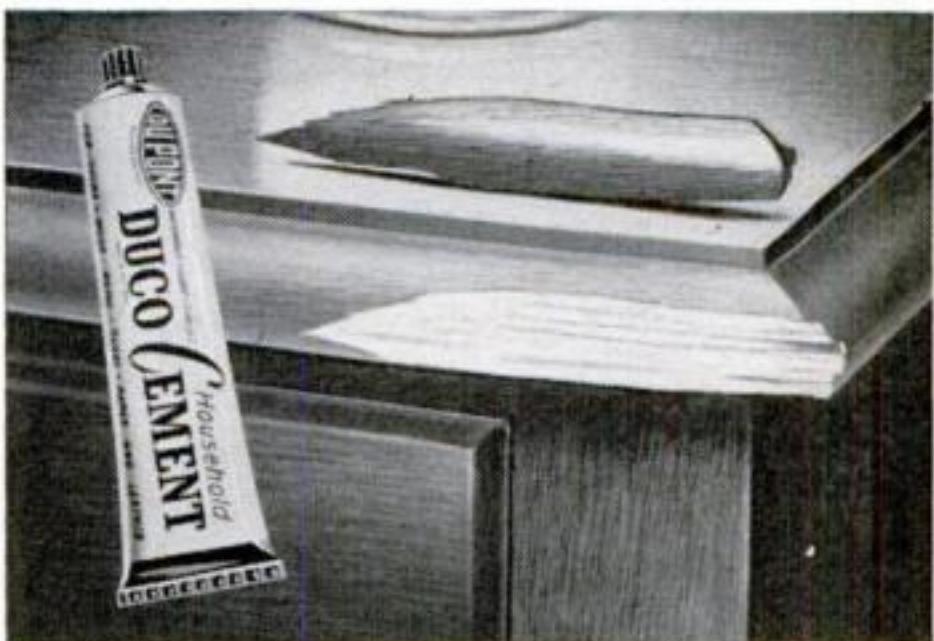
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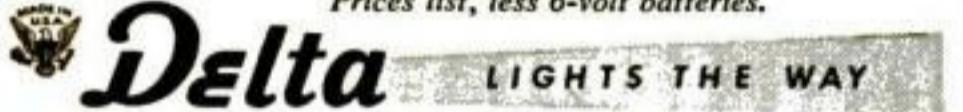
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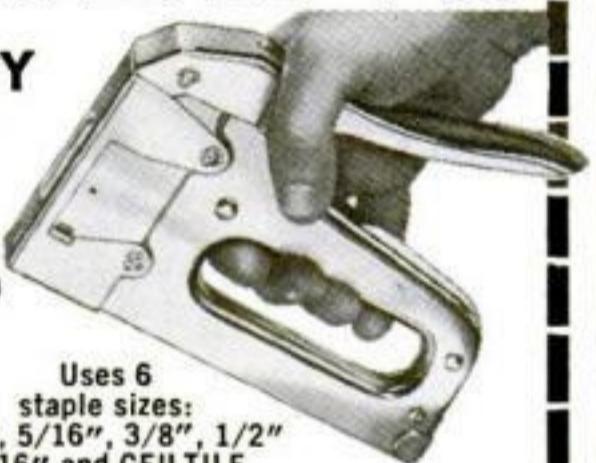
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Spacemen May Talk on Beams of Light

[Continued from page 91]

cording to the kind of messages to be transmitted. If they are in dots and dashes, the modulator chops the beam into short and long flashes, much as a mechanical shutter does. If the messages are spoken, the modulator varies the brightness of the beam instead.

One promising new type of modulator contains a pair of light-polarizing disks and, between them, a small block of plate glass. Normally this array is transparent. But when electrically applied pressure strains the glass, the combination becomes partially-to-completely opaque, in variable degree. This provides the control to dim or extinguish the beam for signaling.

Socom's receiver has a single dishlike reflector. It concentrates the incoming beam on a photomultiplier tube, which converts the flickering light into electrical impulses—and the message is made visible as a written one, or is heard from a speaker.

The range of Socom can be extended by a relay station, a combination transmitter-receiver. It catches a fresh beam of sunlight, applies incoming signals to its modulator, and blinks out a duplicate of the original message.

A Socom network could flash messages back and forth among spaceships, orbiting space stations, a moon base.

A Socom link between space and earth, even though operable only during cloudless nights on earth, might be useful to transmit voluminous scientific data on a non-priority basis.

Engineers expect that a Socom transmitter would be installed on a space vehicle with a nuclear-power source. A relay station, with solar batteries for power, might ride an unmanned satellite. The reflectors that project and receive the message-carrying beam could be aimed by magnetic tape, carrying pre-launch instructions on where to point them. A space version of a Socom transmitter, experts declare, could weigh as little as 30 to 40 pounds.

Why use Socom instead of radio? Because, its developers say, it's simpler, more reliable, lighter, longer-range than radio of equal message-traffic capacity, provides clearer signals, and can't easily be jammed.

How Earth Radio Would Launch ICBMs

[Continued from page 113]

mine—an ideal place to work undisturbed. Their receiver went into a tunnel of the U. S. Borax and Chemical Company mine.

At the start of their day the electronic engineers could truthfully say, "Well, back to the salt mine." They reported at seven a.m. with the first mining shift, rode three miles underground by narrow-gauge railway—and still had a half-mile walk, through a passage only 4½ feet high, to their transmitting test site. The reddish salt of the mine walls made cuts, scratches, and closely shaven faces sting. Taking so long to reach their location and return, the engineers had to stay during two mining shifts; usually they got back to the surface with the swing shift at 11 p.m.

Coming: voice transmission. On July 28, 1960, after numerous attempts, the first signal was successfully transmitted. It traveled a record 4½ miles, at 1,000-foot depth. The feat was performed with a radio-teletype circuit, and a low-power transmitter operating at less than 200 watts' output. With more power, Deco engineers say, voice transmission and 100-mile range would be feasible.

For the Lithocom system of earth radio, the Deco engineers see many possible applications.

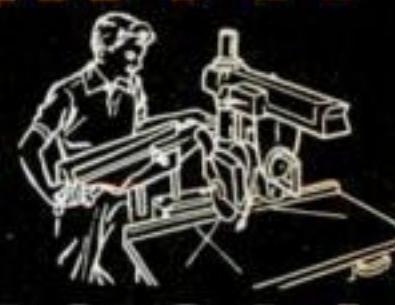
Installed in a large mine, a communication system of this kind could aid everyday operations—and, in an emergency, speed mine-rescue work.

The shielding effect of overlying earth makes the Lithocom system virtually noiseless. Therefore it has interesting possibilities for supplementing more-conventional channels of communication wherever static from electrical storms or man-made electrical noise interferes with their use.

Finally, the engineers note, the alternating wet and dry layers of the earth's crust offer multiple paths for Lithocom channels. Even on the same frequency, messages could be transmitted through different rock belts without interference between them. Will the answer to the problem of overcrowded air waves be to detour radio traffic through the earth? So new is earth radio in its first practical forms that it is still too early to foresee how far this development may go.

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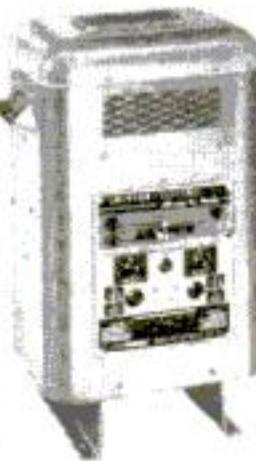
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All-Purpose Yard Horse

[Continued from page 154]

stand pivot. The cart bed is a simple wooden box nested in an angle-iron frame that's fastened to the wheelbase frame by means of three pivot bolts. Biesecker released a spring catch and lifted the front end of the box to show us how it dumped; then he swung aboard the new seat and headed the tractor into a potato patch. In a moment he chugged back with a full load. "It'll tote 500 pounds without strain. Only trouble is, you get lazy," he called as he passed on back toward the barn.

6. The snow plow. It was now time to hook on the largest accessory. "A sheet-metal shop cut and bent the blade for me," Biesecker explained as he laid the long frame flat on the slab floor. After removing the pipe spacer between the top ends of the notched uprights, he lifted the tractor to swing it across and drop it inside the frame's broadest opening. The steering-column braces slipped down the slot formed by the uprights.

With the spacer pipe bolted back in place, Biesecker crawled beneath the cart to raise the back of the plow frame and bracket the upbent ends to the axle. Next, settling himself on the seat, he reached down between his thighs, gripped the handles on the uprights, and hitched the entire frame up until one of the notches hooked onto a short length of rod welded across the top brace. The plow frame and blade now hung suspended, so that when he started the motor he was able to drive the whole assembly out of the barn. We squinted up at the mild, cloudless sky.

"Last winter was great for plow-testing," Biesecker assured us, presenting a snapshot to back him up. "My best traction is when my girl rides in the cart."

The demonstration was complete. But it hadn't exhausted Biesecker's ingenuity. As we tucked away note pad and camera, he patted the transformed scooter thoughtfully. "This is only as far as I've gone," he announced. "I'm now working on a couple of collapsible pontoons and a propeller drive. So this summer, when I ride the scooter up to the lakeshore, I'll just keep on going. And"—his eyes lifted, focusing somewhere out in space—"maybe . . . souped up a little and equipped with rotor blades . . . it'll lift right off the ground . . ."

We fled.

It Tells What Dead Men Can't

[Continued from page 60]

of crews because they "spy" on them, leaving ineradicable traces of poor operation and infractions of rules.

The machine that keeps the record. The recorder is a complex of aircraft instruments, electric servo equipment, and mechanically transported tape. Two kinds now in use have abundantly proved that they can keep their information intact after the severest crashes and fires.

The one that figured in the most spectacular air disaster to date is made by Waste King Corp., of Los Angeles. An electronic box of tricks, it includes a precision frequency generator, a logic circuit, and memory banks. These, with the tape mechanism, relays, amplifiers, and a magazine with enough tape for 200 flight hours, are packed in a box about 5-by-8-by-19 inches.

It was such a recorder, found with other wreckage in the basement of a Brooklyn church, that gave testimony of the DC-8's flight before the crash. The tape had to be soaked in solvent to remove burned insulating material. Then the engraved lines on it—one thousandth of an inch wide and only 70 millionths deep—told their story.

The tape is Inconel foil, which can withstand FAA-prescribed heat punishment without protection. The magazine, of high-tensile steel, prevents impact and penetration damage. Diamond styluses cut or engrave the telltale lines in a dark-gray coating on the foil.

Both sides are coated. The shallow lines show on one side only, and the reverse side of the tape can therefore be used for another 200 hours or, with extra styluses, to record engine and maintenance data in addition to that required by FAA regulations.

A sprocket roller engages holes in both tape edges, holding it back against a constant pull from the take-up spool. To avoid friction that might react on the sensing instruments, the diamond points float free of the tape nine-tenths of the time. Only twice a second, a rotating cam briefly depresses a pressure bar that brings the stylus points against the tape surface.

At this instant, an escapement roller on the timing motor lets the tape move exactly .00167 of an inch under the

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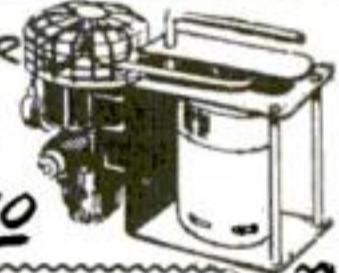
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It Tells What Dead Men Can't

styluses, then locks again. The tiny traces resulting form a continuous line.

How high? Altitude is read from a diaphragm having a vacuum on one side and atmospheric pressure on the other. Its accuracy ranges from plus or minus $\frac{1}{3}$ of one percent at sea level to four percent at 50,000 feet. Air speed is derived from a similar diaphragm with static-line pressure on one side and Pitot-line pressure (caused by the plane's forward movement) on the other. Automatically compensating for altitude, the instrument reads speeds from zero to 450 knots with a plus-minus error of 10 knots.

Heading is derived from the aircraft compass; a servo motor in the recorder positions a scribe within a $\frac{1}{8}$ -inch wide track on the tape. When centered in this, the trace indicates either zero or 180 degrees. A binary (two-position) scribe inserts a jog in a straight line to show whether the trace is to be read as in the top or bottom half of the compass card.

Measuring the Gs. Gravity forces on the plane are measured by a vertical accelerometer mounted at the plane's center of gravity. Memory capacitors store positive and negative signals representing peak Gs—up or down—during any half-second of time. In the next half-second, another memory bank stores such signals. Meanwhile, a logic circuit decides which polarity in the first bank is greater and converts it into an AC signal for the servo that positions the stylus.

Binary scribes have only two positions—on and off—and are set by solenoids. One such scribe marks an edge of the tape with trip number and date in a series of notchlike binary numbers.

Up to 20 additional channels and four binary traces can be added for recording on the reverse side of the Waste King tape. One channel can keep a running record of any one fact about an engine, such as rotor speed and fuel flow.

Four channels can monitor exhaust-gas temperature on four engines. A single servo is connected, by an automatic switch, to the sensing unit on each engine in turn for half a second. It simultaneously moves the scribe to the channel for that engine, then goes to the next, so recording the temperature of any one engine every two seconds.

Mechanical recording. A totally dif-

It Tells What Dead Men Can't

ferent recorder, made by Lockheed Aircraft Service, Inc., is nonelectronic. All data except the heading is mechanically recorded. The entire unit is housed in a 15-inch stainless-steel shell. Its double walls and perlite insulation protect the 2½-inch-wide aluminum tape from impact and fire.

Driven at a speed of eight inches per hour, the foil tape records 125 hours of flight time on a spool. It is transported by a synchronous 400-cycle AC motor, which drives through a torsion spring. This is wound up by the transmitted torque. If power fails, the spring unwinds and keeps the tape running at least 10 minutes longer.

The timing escapement also turns a notched cam. As one end of the time-recording stylus arm drops into the notches, the point marks an edge of the tape at 1-, 15-, and 60-minute intervals. This timing trace, like the other data lines, is embossed on the aluminum foil.

Connected to the static line (a tube open to outside atmosphere) is an altitude bellows. In response to changing air pressure, it moves a counterbalanced stylus arm to mark the altitude. The air-speed bellows responds to speeds up to 450 knots.

Vertical accelerations, or the G forces acting on the plane because of vertical maneuvers, are sensed by a spring-mounted weight under the recorder deck. Its stylus sweeps a narrow trace along the center of the tape.

Course or heading is derived through an amplifier and servo motor from the plane's heading system. The motor positions a cam, which sets a stylus that can sweep almost full tape width.

If the heading is in the east half of the compass, a second cam nudges a second stylus against the tape. This draws a straight line near one edge. If there is no such line, the recorded heading is in the west half of the compass, or between 180 and 360 degrees.

An engine cut out? A near mid-air miss? The pilot can record such events, or the more prosaic one of passing over a given beacon, by pushing a button. A solenoid jogs down the time stylus, making a hash mark that pinpoints the event in relation to heading, speed, and altitude at that instant.

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How Dreams Help Keep Us Sane

[Continued from page 86]

the end of the dream, the large body movements immediately begin again.

It's a fact, too, that mumbling or even distinct talking has nothing to do with dreams but usually occurs between episodes of dreaming.

As to what a dream is, you can't tell very much. You get some clues from the nature of the eye movements which indicate where the dreamer is looking. Up and down movements are connected with dreams involving climbing and similar vertical activities. Side to side movements characterize dreams that concern watching activities on a horizontal plane.

What kinds of dreams do people have?

Almost a third are in color, the rest in black and white, with women and younger people tending to dream more in color than men and older people.

But two-tone or otherwise, only a minority of dreams are loving or friendly. In 64 percent, Dr. Hall's studies indicate, hostility is the chief emotion. Actual murder turns up in only one of every 50 hostile dreams, but there's plenty of violence and violent talk.

Psychiatrists explain that this is so because in dreams we are not inhibited. We can express feelings we conceal from others and even deny to ourselves when awake—which makes dreams a good safety valve, and pleasurable as well.

Incidentally, in men's dreams, hostility is mostly directed against other men and friendliness is usually for women. But in women's dreams, friends and foes are of both sexes. From this some have concluded that while a man doesn't have much doubt about who his friends and enemies are, a woman never knows.

The sameness of dreams

Many people have certain dreams repeatedly. That, according to psychoanalytic studies, is because infantile wishes of childhood never disappear as long as they are suppressed. They keep working on the unconscious and stimulate the same dreams.

Also, according to Dr. Louis Robbins of the Menninger Foundation, everyone

tends to suppress the same kind of infantile impulses—complete selfishness, for example. That's why there often are elements of similarity in the dreams of different people.

"Because of these similarities," Dr. Robbins adds, "some people believe that dreams, or parts of dreams, have fixed meanings and 'dream books' claim to enable anyone to interpret his dreams. The fact is, a black cat or an express train may have a different meaning for everyone." It takes an expert to interpret a dream—and the interpretation must be based on a lot of facts about the dreamer's life and experiences.

Who dreams most?

Generally, young people dream more than older people, women more than men, and those with high IQs more than those of lesser intelligence. These are the conclusions of studies such as those of Dr. Calvin S. Hall Jr., of Western Reserve University, who interviewed enough people to collect 10,000 dreams.

Do dreams foretell the future?

The Bible, of course, is full of prophetic dreams, including Joseph's famous one of the seven lean and seven fat years. Julius Caesar's wife is said to have dreamed that he would be assassinated. Abraham Lincoln, according to Ward Lamon, his friend and biographer, not only dreamed in advance of his own assassination but of every important Northern victory during the Civil War.

Skeptics say that with 2½ billion people in the world dreaming every night, it's only natural that occasionally one of them chances to dream of an incident that actually happens later on.

But some scientists think they now have a reason why dreams sometimes can be prophetic. Since dreams express hidden wishes, they say, a prophetic dream may merely show what the dreamer wants to happen in his life—and what he goes about achieving when awake even if he doesn't realize what he's doing. If he dreams, say, about a business or personal failure, and that actually happens later, it may be because he unconsciously

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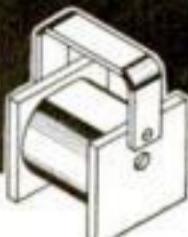
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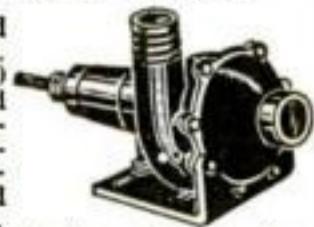
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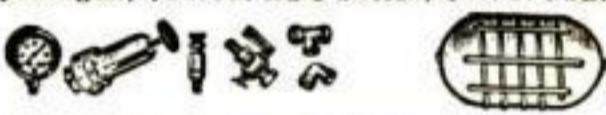


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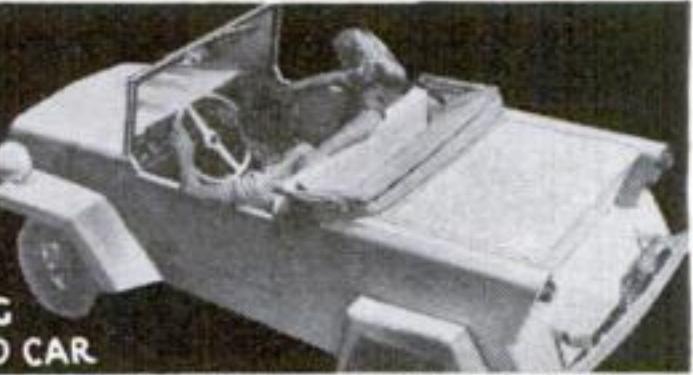
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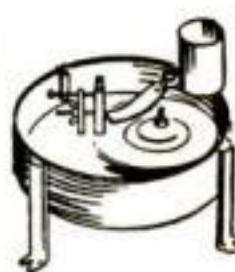


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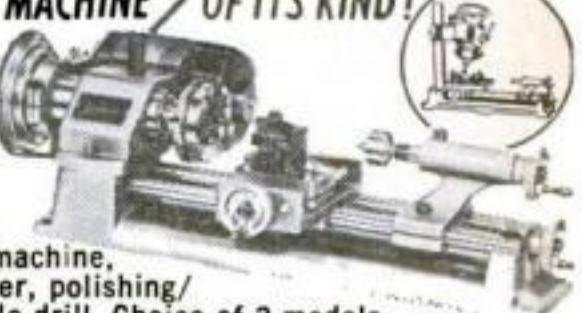
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CLASSIFIED OPPORTUNITIES

Weekend Painters get a break with a new kind of Latex House Paint!

If you're planning to paint the outside of your house this year, there's a new kind of house paint from "Dutch Boy" that can make your job a lot easier. It promises professional results to even first-time painters!

Until recently, the weekend or vacation painter had to wait for an extended period of good weather. Now new "Dutch Boy" Latex can be used even right after a rainstorm. And it's specially helpful for the stop-and-go kind of exterior painting that most homeowners have to do. With this remarkable new paint, you can pick up right where you left off. Lap marks won't show. Skips and holidays can be touched up any time.

Extremely easy to apply, there is no tiring brush-drag with new "Dutch Boy" Latex. On certain exterior surfaces, you'll find a roller works perfectly. This new paint literally flows on over wood and masonry—and it covers fast and evenly. This easy application means that two coats go on in little more than the time it takes to apply one of regular paint.

When repainting surfaces with "Dutch Boy" new Latex, there's no need for a separate oil-type primer with all its complications. Instead, you simply use the easy-to-mix additive, PBL, with the first coat... "Dutch Boy" does the rest.

You have a paint job that dries, bug-free, in just 30 minutes. Add the second coat when convenient.

Messy solvents and thinners are unnecessary, too. Brushes and equip-

ment—like the painter himself—can be cleaned up with soap and water.

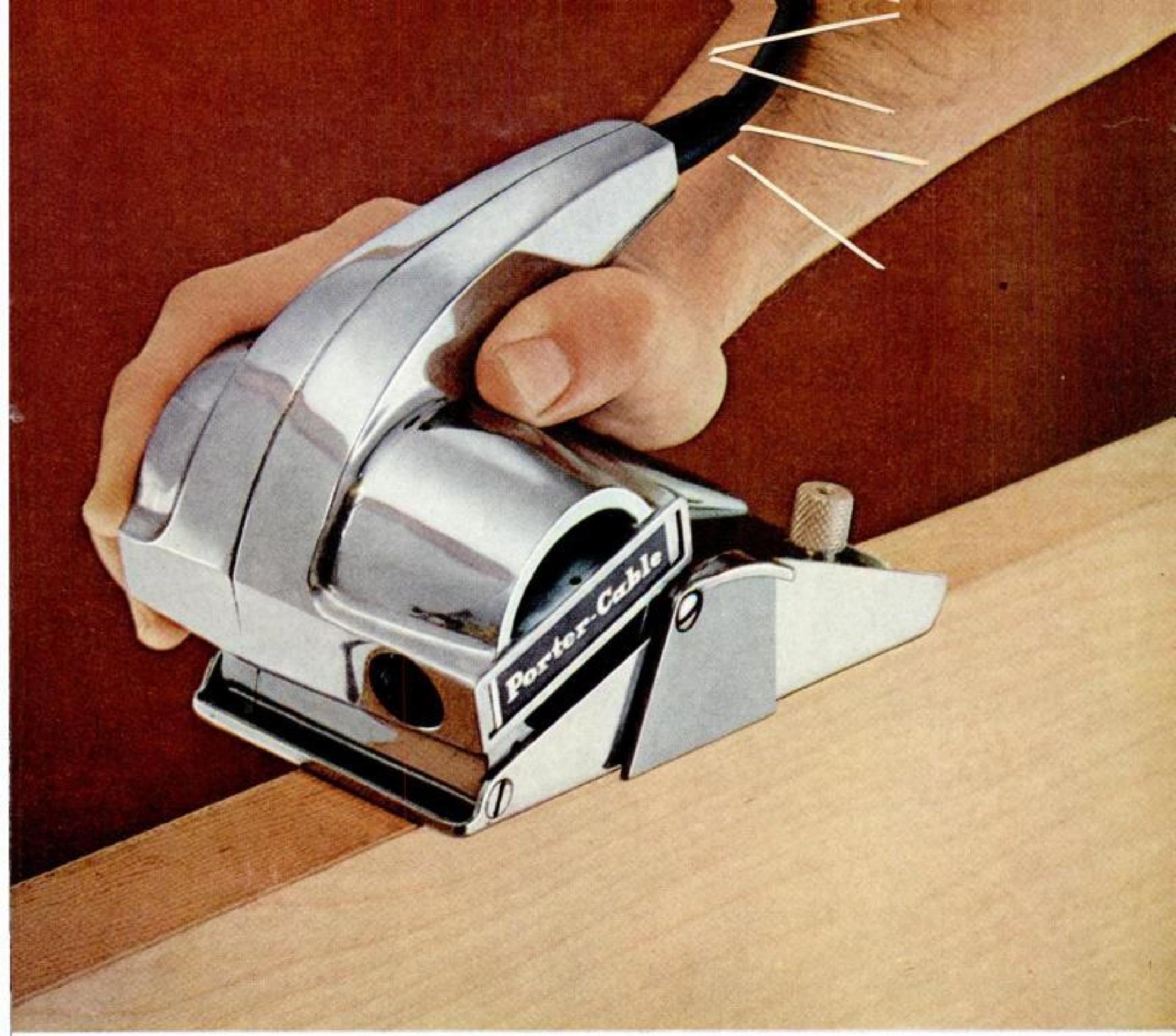
Homeowners who have used new "Dutch Boy" Latex House Paint claim it ends exterior house painting as they've known it before. It's an easy, simple, low-cost way to have a complete exterior paint maintenance program. Once applied, new "Dutch Boy" Latex lasts for years and years. Colors will stay bright and clear. Simple one-coat touch-up is all you will ever need. The part of a house exposed to more severe weathering can be repainted at any time *without repainting the whole house*. So long as you keep the same color, your Latex program means that you may never again need to repaint the outside of your entire house at one time.

Properly applied, this new paint can eliminate most blistering and peeling problems caused by trapped interior moisture. New "Dutch Boy" Latex House Paint "breathes"—allowing interior moisture to escape yet sealing out the weather.

This new paint promises much to the do-it-yourself homeowner. Check with your nearest "Dutch Boy" Dealer listed in the Yellow Pages, or write for informative free booklet to: NATIONAL LEAD COMPANY, General Offices, 111 Broadway, New York 6, N.Y.

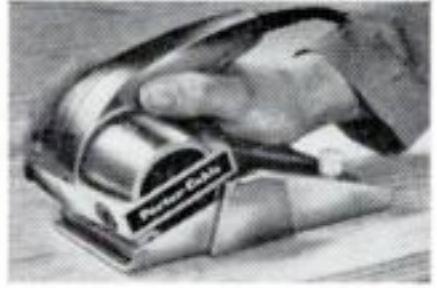


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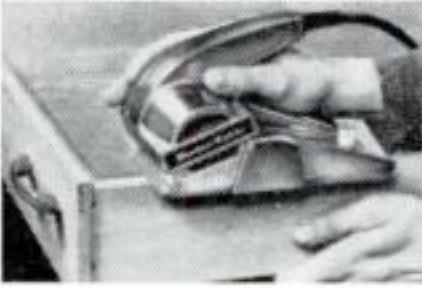


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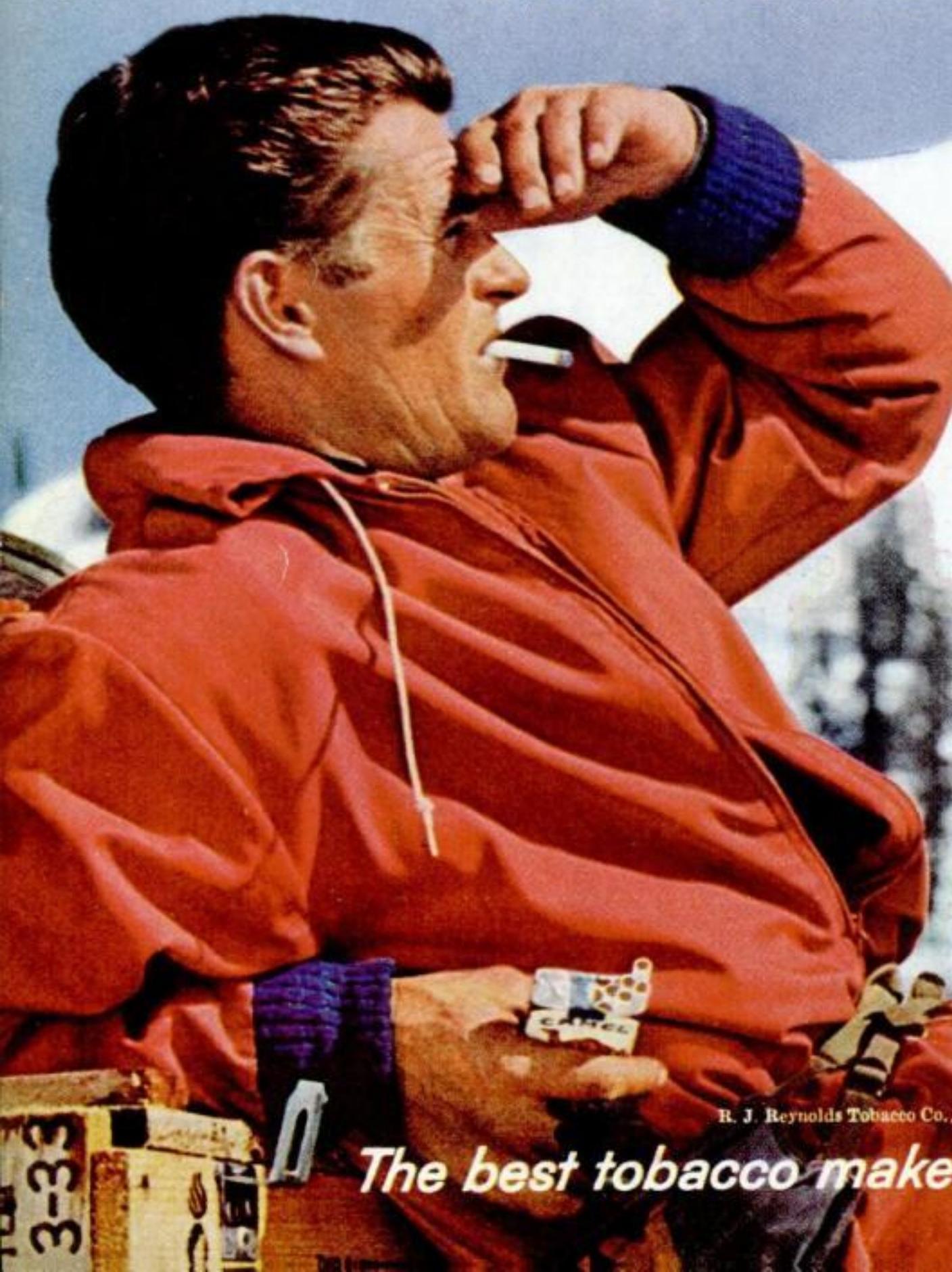
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